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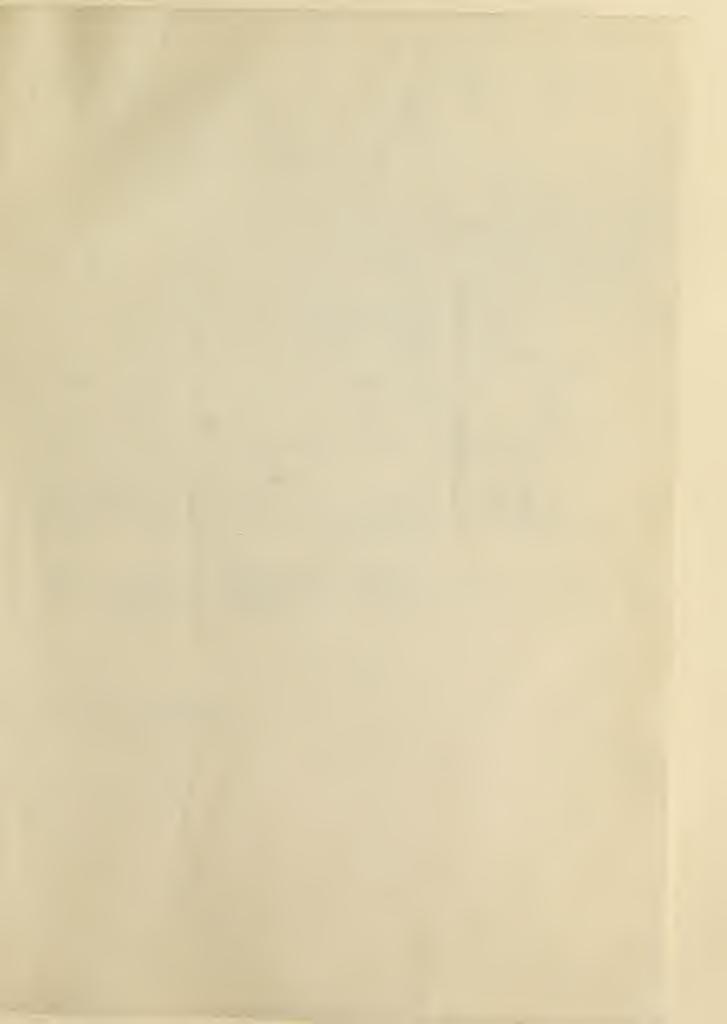
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Nutrition Programs Branch

December 15, 1943

MEMORANDUM

To: Miss Jessie W. Harris, Chief, Nutrition Division

From: Nora M. Kefauver, Assistant Home Economist, Nutrition Division

Subject: Report on Cereals-Whole, Processed, Enriched

According to the request of, and with the supervision of, Miss Mabel R. Stimpson, Nutritionist, the following report has been made.

Data have been collected on the flour and bread enrichment activities of recent date. Source material included texts, reviews, journals, and government, state, and commercial publications. By combining material from several references, tables of comparative values have been set up.

Herein are copies of the tables and of pertinent information which has been recorded in such a way that queries of practical nature may be quickly answered with documentation.

cc: Miss Mabel R. Stimpson Dr. Robert S. Goodhart

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December 15, 1943

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Po: 138 Josefe .. Marris, Chief, Atrition Division

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Food Distribution Administration Nutrition Programs Branch Washington, D. C.

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Food Distribution Administration Natrition Frograms Branch Washington, D. C.

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PLACE IN DIET:

Nutrition Reviews, Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C.,

June 1943, 8 page 238: "In a recent study, Willard (Am. J.

Publ. Health, 32, 996 (1942) found that a dietary survey of

1169 school children in Worchester County, Maryland, "more
than confirmed the impression of poor dietary habits and existence of a nutritional problem". Informationwas collected concerning the intake of 5 principal groups of foods: milk,
vegetables (except potatoes), fruit, cereal or whole grain,
and meat. It was revealed that only 41 percent of the children
received 2 or more cups of milk per day. In the opinion of
the author, only 19 percent consumed adequate vegetables, 20
percent sufficient fruit, and 41 percent adequate cereal or
whole grain. In contrast, 97 percent of the children were
thought to receive sufficient meat."

Sherman, H. C., and Constance S. Pearson, Modern Bread, The MacMillan Co., 1942, (389.1 Sh5M), page 14: "Typical estimates from summaries in other Government publications and by Cummings (1940) show 19 per cent of the food calories furnished by breadstuffs in the dietaries of professional men's families, 27 percent in well-to-do farm families, 39 percent in workingmen's families, 54 percent in poor

southern farm families."

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Intriction crieful, Intriction Foundation, Inc., Chrysler Bldr., 7.1.0., June 1915, 8 page 250: "In a recent study, Willard (1.1.1.1) while feath, 35, 676 (1942) found that a dietary survey of lift school ohildren in Werchester Crunty, Tryland, Encretion of a nutritional the impression of poor liet my habits and existence corrier the intake of 5 principal groups of foods: milk, certainest as (except rotatoes), fruit, certail or whole grain, sud meat. It was revealed that only it persent of the children recent afficient fruit, and it persent adequate vegetables, 20 nercent sufficient fruit, and it persent adequate certail or hole grain. It occirest, 97 persent adequate certail or thought to receive sufficient meat."

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COMPOSITION OF:

Cooper, Barber, and Mitchell, Nutrition in Health and Disease, J. B.
Lippincott, Philadelphia, 1941, page 439: "The cereals are the hard kernels or seed-like fruits of certain plaints of the grass family."

"Yellow corn meal ranks first for Vit. A content, while wheat and oats are rich in the vit.B.complex. The general composition of

cereals is as follows:

The seed kernel of the grain plant is composed of three parts: germ endosperm, and bran coat or husk. The endosperm makes up about 85 percent of the wheat, as it contains all the material stored for use by the developing grain. The food is stored mainly in such forms as starch grains and gluten granules. The husk or bran is largely cellulose plus a large part of the mineral and vitamin B complex of the grain. The germ is the tiny portion which sprouts when the seed is planted and is the portion which spoils first in whole grain products. Theat germ practically free from bran is now on the market and serves as a palatable cereal supplement high in vitamin B complex and vitamin B. Toveral cereals are now fortified with extra wheat germ or other source of the B vitamins. The keeping quality of wheat germ or products containing it has been improved by some method of sterilization."

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FUNCTIONS OF ELEMENTS IN:

Sherman, H. C. Chemistry of Food and Nutrition, MacMillan Co., N.Y.C., 1941, page 378: "For the purposes of this book, it seems sufficient to call attention to the fact that the findings of several investigators show that compounds (we do not yet know how many) of thiamine, of riboflavin, and of nicotinic acid all function in the complex enzyme-coenzyme systems which catalyze the oxidation process in the body tissues, and that there may be interrelations in their action."

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THIAMIN, Effect of Deficiency on Human Nutrition:

Parran, Dr. Thomas, "Nutrition and Public Health", The Food Front, F.S.A.

1942, (173.3 H34F), page 13; "Dr. Wilder, in Nayo Clinic, has
carried on a number of studies in recent years designed to show the
role of thiamin in human nutrition. He took three groups of
patients, one on an optimum diet, one on an average diet, and the
third on a diet deficient in thiamin - that is, vitamin B1. It was
perfectly clear from those experiments that where thiamin was deficient physical vigor went down, total capacity for work went down,
and more of the third group of patients developed phobias and apprehensions concerning situations about which they could do nothing.
In other words, there was a lack of morale. It over-simplifies the
problem to say that this is a morale weapon, but it is certain that
this vitamin has much to do with the metabolism of brain and nerve
tissue of the whole nervous system. Lack of it does produce serious
effects.

"In a second series of experiments, Dr. Wilder was interested in determining the degree of efficiency among these patients. He found the third group inefficient. In doing household tasks they were clumsy - they dropped the dishes and broke them. Others who were skilled with their needles became clumsy and couldn't do crocheting or knitting with anything like their former speed or accuracy."

Annual Review of Biochemistry, Stanford University, 1943, (381 An7), page 322:

"Thiamin deficiency was found to decrease physical endurance, as measured by tests involving holding out the extended arm and holding the breath, and its administration greatly increased the endurance." From: McCormick, W. J., Medical Record, 152, 439-42 (1940).

- Nutrition Reviews, The Nutr. Foundations, Inc., Chrysler Bldg., N. Y. C.,
 Way 1943, 7, page 210: "The question in point is whether thiamine
 degrivation is responsible for nerve degeneration. There is no
 question that acute thiamine deficiency produces neuropathologic disturbances and that crystalline thiamine administration alleviates these
 symptoms in a short time."
- Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C.,
 November 1912, 1, page 29: "Thiamin deficiency in man may manifest
 itself in a variety of ways, e.g., anorexia and neurasthenic symptoms,
 multiple neuropathy, central neuropathy (Wernick's Syndrome), and
 Cardiovascular dysfunctions. It is almost invariably associated with
 other nutritional deficiencies or organic or psychological abnormalities which complicate the picture and make the diagnosis difficult."
 from: Swank and Prados (Arch. Neurol. Psychiat. 47, 97 (1942)).

Journal of the American Dietetic Association, April, 1912 (Vol. 18, No.4),
"Why Enriched Bread?", by Williams and Wilder: "The vitamins, thiamin,
and niacin, are needed to assimilate a starchy food-like bread.
Without them, poisonour products are formed within the body by incomplete combustion of this food."

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Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Building, N.Y.C., January 1943, 3, page 73: "White flour of a hundred years ago was probably an excellent source of thiamine."

"It was concluded that the best white flours of a century ago must have contained concentrations of thiamine comparable to those of the whole grains from which they were made. In a footnote, the authors state that further work has shown that stone milled flours are also proportionately richer in other members of the B-complex, as well as in ash." (Cereal Chem. 19, 529 (1942)).

Wilder, Russell M., Han., 1943, Vitamin B₁ (Thiamin), Annals of the American Academy of Political and Social Science, 225, (280.9 Am34), page 29:

"White patent flour retains little more than a tenth of the thiamine in wheat; and bread makes up a sizable fraction of the average diet." "Pasing calculations on the disappearance of food products of human consumption in the United States, Lane and co-workers (J. Nutrition, 23, 613-24, June 1943) conclude that the total provision of thiamine does not exceed an average of 0.32 mg. per 1,000 calories. This figure equals that defined by the United States Food and Drug Administration as the minimal daily adult requirement necessary to prevent actual disease. The minimal daily requirement to prevent biochemical abnormality, as determined by Williams and co-workers, is 0.45 mg. per 1,000 calories. The allowance recommended by the Food and Nutrition Board of the National Research Council is 0.6 mg. per 1,000 calories. If the average person receives only 0.32 mg. per 1,000 calcries, it should be obvious that millions of our population are suffering from actual deficiency disease and that relatively few diets provide enough thiamine for full health and efficiency."

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Building, N.Y.C., December 1942, 2, page 54: "In a tabulation of the thiamine in the foods used to make up the "average American diet", it appears that cereals and meat each supply about one-fourth of the total thiamine eaten, dairy products and vegetables supply one-fifth, and fruits about one-tenth. Interestingly enough, in the table showing the contribution of various foods to the total diet, pork, milk, and bread appear as principal contributors. It is estimated that if the conventional white bread were replaced by "enriched bread" in such a diet, the cereals would supply one-half of the totalthiamine and would raise the average intake of 0.78 mg. to 1.28 mg. per 2500 calories. Thus it appears that the use of whole wheat or enriched bread can raise the thiamine value of the "average American diet" from more than 20 percent below to almost 30 percent above the minimum requirement (about 1 mg.) of thiamine as reported recently by Melnick. In other words, the thiamine value would thus be raised to about 0.5 mg. per 1000 calories but it would still fall short of the 0.6 mg. per 1000 calories recommended by the National Research Council for good nutrition." from: Lane, Johnson, and Williams (Journal of Nutrition, 23, 613 (1942)), studies to determine the thiamine content of the average American diet.

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The Journal of the American Dietetic Association, April, 1942, "Why

Enriched Bread?", by Williams and Wilder: "The most important
source of thiamin among the foods consumed in amounts large
enough to matter is wheat. A first result of deficiency of
thiamin is loss courage and the will to do or die. Insufficiency
of this vitamin in many diets comes mostly from use of ordinary
white flour and its products. Therefore it is extremely urgent
that thiamin be put back into flour and bread at once."

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C.

Nov., 1942, 1, page 11: "Thus we know that Thiamine, riboflavin,
and pyridoxine are concentrated in the germ portion of the wheat
but niacin and pantothenic acid are not." from studies by Tepy,

Strong, and Elvehjem (J. Nutrition 24, 167 (1942).)

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NIACIN In:

Annual Review of Biochemistry, Stanford University Press, 1943, (381 An7 vol.12), page 327: "Acid or alkaline digestion converts unknown substances in grains into miacin and thus tends to yield high values." from: Cheldelin, V. H., and Williams, R. R., Ind. Eng. Anal. Ed., 14, 671-675 (1942).

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Feb. 1943, 4, page 121: "No loss of nicotinic acid occurs in the production of bread from enriched white flour or from whole wheat

flour (Cereal Chem. 19, 553 (1942)".

Nutrition Review, The Nutrition Foundation, In., Chrysler Bldg., N.Y.C., Nov. 1942, 1, page 4: "Corn, oats, and rye range from 10 to 15 micrograms per gram, but buckwheat, barley, and wheat are considerably higher, 45 to 70 micrograms per gram. As expected, most of the vitamin is present in the bran and middlings". "Peanut butter, however, contains 186 micrograms per gram and ranks with liver as a source of niacin."

Page 11: "A recent study by Tepy, Strong and Elvehjem (J.Nutrition 24, 167 (1942)) fills several gaps in our knowledge of the contribution of wheat and wheat products to the dietary intake of

niacin, pantothenic acid and pyridoxine.

"Four varieties of dark hard winter wheat, each grown in four different localities of Mansas and Mebraska, were analyzed. Neither varietal nor environmental differences seemed to exert a significant influence on the amount of pantothenic acid and pyridoxine present. The niacin content was apparently dependent to some extent on both the variety and the environment. However, all the above samples, and most of some 40 miscellaneous wheats, contained from 55 to 65 micrograms of niacin, 10 to 15 micrograms of pantothenic acid, and 4.0 to 5.0 micrograms of pyridoxine per g. of wheat.

"Fifty samples of milled patent and clear flours indicate that the milling loss of niacin, pantothenic acid, and pyridoxine is approximately 83, 57, and 52 percent respectively for patent flour and 64,

28, and 15 percent respectively for the first clear flour.

"Wheat germ contains only 34 micrograms per g. of picotinic acid,

9.6 of pyridoxine, and 15 of pantothenic acid.

"Thus we know that thiamine, riboflavin, and pyridoxine are concentrated in the germ portion of the wheat but miacin and pantothenic acid are not. The addition of small amounts of the germ to flour would not be an effective means of raising the concentration of the latter two vitamins in flour or bread, and it would appear that the nutritional improvement given to bread by including 5 percent of germ cannot be attributed to the addition of these two members of the B-complex."

The Journal of the American Dietetic Association, April 1942, "Why Enriched Bread?", by Williams and Wilder: "A first result of deficiency of thiamin is loss of courage and the will to do or die. Insufficiency of this vitamin in many diets comes mostly from use of ordinary white flour and its products. Therefore it is extremely urgent that thiamin be put back into flour and bread at once. This argument applies with equal force to niacin."

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Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Nov., 1942, 1, page 11: "Thus we know that Thiamine, riboflavin, and pyridoxine are concentrated in the germ portion of the wheat but niacin and pantothenic acid are not." from studies by Tepy, Strong, and Elvehjem (J. Nutrition 24, 167 (1942))

Cereal Chemistry, American Association of Cereal Chemists (Lancaster, Pa.),
September, 1943, Volume xx (59,8,033), page 557: "The fact that
nearly half the total niacin of the wheat appears in the bran
stream leads to the conclusion that the niacin of the wheat kernel
must be largely contained in the branny layers. The data also
show that the site of the highest concentration of niacin in the
wheat kernel is quite different from the site of the thiamin."

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Lart ther, 19/3, Volume at (59,8,033), nor 557: "The fact that

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show that the site of the highest concentration of risein in the

wheat hand is quite different from the site of the thiamin."

RIBOFLAVIN In:

Annual Review of Biochemistry, Stanford Univ. Press, 1943, (381 An7 Vol.12), page 325: "A parallel was found between the thiamin and riboflavin contents of cereals and milled products." from: Andrews, J. S., Boyd, H. M., and Terry, D. E., Cereal Chemistry, 19, 55-64 (1942)

"Other investigators reported the existance of factors in photolyzed extracts of whole wheat flour and in extracts of rice and wheat bran which stimulate acid production and interfere with the proper evaluation of the riboflavin content of cereal products." from:

Wegner, M. I., Kemmerer, A. R., and Fraps, G. S., Journal of Biological Chemistry, 144, 731-35 (1942).

"Light destruction of riboflavin in foods has been found to be rapid and to be influenced by pH and temperature, which are secondary factors."

from: Williams, R. R., and Cheldelin, V. H., Science, 96, 22-23(1942). "Sliced bread may lose riboflavin by being exposed to light under ordinary conditions." from: Andrews, J. S., Boyd, H. M., and Terry, D. E., Cereal Chemistry, 19, 55-64 (1942).

Sherman, H. C., and Lanford, Caroline S., Essentials of Nutrition, MacMillan Company, N.Y.C., 1943, page 226: "Whole wheat contains only about one-fourth as much riboflavin as thiamin. The germ or embryo is richer in both of these factors than is the entire grain."

Batchelder, Esther L., Jan. 1943, "Riboflavin", Annals of the American Academy of Political and Social Sciences, 225, (280.9 Am. 34), page 32:

"Reports of widespread occurance of riboflavin deficiency disease, diagnosed by qualified observers, indicates that the diet of many Americans is too low in this factor. Milk, liver, kidney, and eggs are generally recognized as dependable sources of this factor. Whole-grain cereals are not very rich on a weight basis, but if used instead of refined products, can appreciably increase the intake of this vitamin."

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Nov. 1942, 1, page 11: "Thus we know that Thiamin, riboflavin, and pyridoxine are concentrated in the germ portion of the wheat but miacin and partothenic acid are not." from studies by Tepy, Strong, and Elvehjem (J. Mutrition 24, 167 (1942)).

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PAUTOTHENIC ACI In:

The Journal of Mutrition, August 10, 1943, vol.26, no. 2, page 137, "Digestion of Whole Wheat and White Breads in the Muman Stomach", by Rosterfer, Mochakian, and Murlin (Rochester Univ.): "The peeled-wheat bread with high-vitamin yeast undergoes gastric proteolytic digestion 157 faster than when the bread is baked with ordinary bakers' yeast; the free sugar formation under the amylolytic action of saliva is 115 faster. Calcium pantothenate in 16 mg. doses taken at least twice before the meal (8 to 10 hours and 1 hour) accelerates the two digestion rates to about the same extent. Pantothenic acid in the test meal of high vitamin yeast bread exceeded that of the same broad baked with ordinary yeast by only 0.45 mg. If this is the only vitamin B-factor affecting digestion rates, it appears that a relatively small amount in the bread is as effective as a much larger amount taken before the meal."

Nutrition Leviews, the Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C.,
Now. 1942, 1, page 11: "Thus we know that Thiaming riboflavin,
and pyridoxine are concentrated in the germ portion of the wheat
but niacin and pantothenic acid are not." from studies by Tepy,
Strong and Elvehjem (J. Nutrition 24, 167 (1942)).

The Journal of Mutrition, August 10, 1943, vol.26, No.2, page 172, "The Effects of Pantothenic Acid and Inositol Added to Whole Wheat Bread on Evacuation Time, Digestion and Abscrption in the Upper Gastro-Intestinal Tract of Dogs", by Bly, Heggeness, and Nadset (Univ. of Rochester): In enterostomized dogs maintained exclusively on a peeled whole wheat diet, a severe deficiency was produced in the course of 2 to 3 months. This was characterized by an approximately 50% decrease in gastrointestinal motility, accompanied by 40-60% decrease in the rates of carbohydrate and protein digestion and absorption. The almost immediate effect of adding a supplement of 220 ug. of calcium pantothenate per kilogram of dog weight per day to this diet was the return of these functions to normal in every case. The total digestion remained practically the same in the normal deficient states.

"Pyridoxine was ineffective in altering the course of the deficiency.

"Inositol acted more as a cathartic, its effect being apparently superimposed on the deficiency. While the motility was temporarily improved, the total amounts and rates of digestion and absorption were greatly decreased."

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The Journal of Nutrition, August 10, 1943, Vol. 26, No. 2 (389.8 J82), page 172, "Whole Wheat Bread and Gast. Int. Tract", by Bly and Others (Univ. of Rochester): "In enterostomized dogs maintained exclusively on a peeled whole wheat diet, a severe difficiency was produced in the course of 2 or 3 months

"Pyridoxine was ineffective in altering the course of the

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MANGANESE IN:

Cereal Chemistry, Lancaster, Pa., Vol XX, No. 3, May, 1943, "The Manganese Content of Bread and Wheat Products" (page 328) by Schweitzer and Dalby of Ward Baking Co., N.Y.C.: Experiments in this laboratory show that the manganese content of a loaf of bread serves as an indicator of the degree of extraction of the flour used in making the loaf. The fact that manganese varies with the ash of a flour has been known for some time. . . McCarrison (1927) pointed out that the milling of cereals reduces the manganese in the diet below the safety point and favored the use of whole wheat bread by children because of its higher manganese content. . . Manganese and ash are closely related factors. Whole wheat flours average 35-40 micrograms per gram, whereas standard patent flours average about 4 micrograms per gram."

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IRON In:

Annual Review of Biochemistry, Stanford University Press, 1943, (381 An7 vol.12), page 259: "Free and Bing reported that several varieties of wheat contained 2.90 to 4.87 mg. of total iron per 100 gm. Chemical studies indicated the iron was 73 to 88 percent ionizable, and in studies with rats the iron of two varieties of wheat was found to cause almost as much hemoglobin regeneration as equal amounts of ferric chloride." from: Free, A. H., and Bing, F. C., Journal of Nutrition, 19, 449-60 (1940)

"On the basis of long-time balance studies with adult human subjects, Widdowson and McCance found that iron was well absorbed from a diet in which white flour bread constituted 40 to 50 percent of the calories. Iron was less efficiently absorbed, however, from similar diets when the white flour was replaced with a flour of 92 percent extraction." from: Widdowson, E. M. and McCance, R. A.,

Lancet, 1, 588-90 (1942)

Nutrition Reviows, July 1963, The Nutr. Foundations, Inc., Chrysler Bldg., N.Y.C., 9, page 269: "Nakamura and Mitchell (J. Nutrition 25, 39, (1943)) point out that difficulties may be encountered in meeting the federal specifications regarding the addition of iron to flour as part of the enrichment program. Iron salts which are not insolvable may cause adverse reactions such as rancidity in the flour. A study was made, therefore, of the degree to which the several iron salts commonly incorporated in flour (iron phytate, sodium iron pyrophosphate, and ferrum reductum) were utilized for the production of hemoglobin." The iron in sodium iron pyrophosphate and in ferrum reductum was as well utilized as was the iron in ferric chloride. The iron in ferric phytate, however, proved to be definitely inferior and stimulated hemoglobin formation only about half as much as did ferric chloride.

"Widdowson and McCance (Iancet 1, 558 (1942)) obtained some evidence that human subjects utilize the iron of white bread more completely than the iron of 92 percent extraction bread. This may be related to the fact that iron phytate occurs only in the outer layers of the wheat kernel while the iron in patent flour is largely inorganic, and originates to a considerable extent from the milling process."

Sherman, H. C., and Constance S. Pearson, Modern Bread, MacMillan Co., 1942, (389.1 Sh5M), page 41: "Rose and Vahlteich (1932) found the iron of whole wheat and of bran, as also of oatmeal, to be effective in hemoglobin fermation. Patent flour also fostered hemoglobin to some extent; but patent flour with added iron was not so effective as the same total amount of iron in the form of whole wheat. They concluded that either the iron in oatmeal and whole wheat is more effective than that of white flour enriched with iron, or that the whole-grain products contain something else as well'as iron which is favorable to the assimilation of iron and the formation of hemoglobin."

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Sherman, H. C., and Constance, S. Fearson, Modern Bread, MacMillan Co., 1942 (389.1 Sh5M), page 96: "Addition of iron is thought by British experts to involve a risk to the stability of some of the other nutrients of the flour and is therefore not recommended for the British "national bread".

"Meanwhile, in America the addition of iron to white flour is already being practiced to a considerable extent, while the addition of calcium is still only tentatively suggested."

page 101: "Whole wheat is an excellent source of nutritionally efficient iron; but about four-fifths of it has been and is rejected in the milling of ordinary white flour, Enriched white flour is, in the United States, to have at least a significent share of the original iron content restored."

The Journal of Nutrition, August 10, 1943, (389, 8 J82), page 194, "A Study of the Availability of the Iron in Enriched Bread": "Sodium iron pyrophosphate, administered to rats maintained on a diet of whole milk, has been found to have an availability of considerably less than 50% as compared to the utilization of ferrour or ferric sulfate. Likewise, when enriched bread containing sodium iron pyrophosphate or ferrous sulfate was fed to anemic rats, the availability of the former compound was less than 50% of that of the ferrous sulfate.

"After this paper was submitted, an article appeared by Makamura and Mitchell ('43), which calls for comment. These workers reported that the utilization of iron as sodium iron pyrosphosphate or ferric chloride is equally satisfactory as tested in anemic rats. It is difficult to reconcile these findings with those reported here. Mitchel (143) has pointed out that in their experiment the iron compounds were administered daily, in constrast to the thriceweekly administration of the iron salts in the present study. However while this might account in part for the difference observed when the iron salts were administered as such, it would not explain the poor utilization of sodium iron pyrophosphate when fed in enriched bread ad libitum. It should also be pointed out that while the preparations of sodium iron pyrophosphate were obtained from the same manufacturer, they were, of course, different samples, and this might to some extent account for the variation in degree of utilization."

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PROTEIN IN:

Nutrition Reviews, The Nutrition Foundations, Inc., Chrysler Bldg., N.Y.C., 5, March 1943, page 131: "It is inevitable in wartime to find a shortage of meat and dairy products, our most valuable source of good protein. The possibility of extending the protein supply of the diet by more effective use of wheat has received consideration. The by-products of the milling of white flour not only are richer in iron and in the vitamins of the B-complex, but they also have a higher protein content. Would there be any advantage from the point of view of the proteins, if whole wheat flour were substituted for white flour? Two recent reports show conclusively that whole wheat flour is digested almost as completely as white flour, and that its proteins are of higher biologic value."

flour, and that its proteins are of higher biologic value."

Food Field Reporter, N.Y.C., Sept. 6, 1943, "Proteins of Whole Wheat

Surpass White Flour", page 24: "The Biologic value of the proteins
in whole wheat flour was found to be superior to that in white flour
in studies done by Chick and reported in the English Journal "Lencet".

His work was commented on in a recent issue of "Nutrition Reviews".

"Experiments showed that 19.5 grams of the proteins of whole wheat were as useful to the rat as 13.1 grams of white flour proteins.

"In two experiments it was found that 87.9 and 86.8 percent of the protein in white flour was digested and absorbed as compared to 85.4 and 83.2 and 81.7 in whole wheat meal. This investigation pointed out that the slight difference in digestibility favoring white flour is more than compensated for by the greater biologic value of national wheat meal or by the whole wheat meal in the promotion of growth."

utrition Periods, its labration Consistions, Inc., Chrysler lide., 7.1.6., 5, 1 mon 1943, rept 181: "It is travitable in northme to lited a slorte e of met and delay produced our most volumeder ourse of mod rotein. The presidely of extending the protein supply of the did by more effective use of wheat has received considerables. The brancourts of the cillian of white flour not only are ribber in it of any interview of the complex, but they also have a higher protein content. Tould there be any seventage from the noist of view of the proteins, if whole wheat flour were substituted for the liter of the recent reports show conflucively that whole wheat flour is directed almost as conflictly as white

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CALCIUM ADDED:

Sherman, F. C., and Constance S. Pearson, Modern Bread, MacMillian Co., 1942 (389.18h5M), page 96: "In the above mentioned British report, it is stated as "known" that intake of calcium in the diets of Great Britain, especially among the poorer classes, is frequently too low for satisfactory nutrition and that calcium is therefore to be added to the national flour.

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DIETARY HABITS IN VARIOUS COUNTRIES:

Journal of the American Dietetic Association, April 1942, "Why Enriched Bread?" by Robert R. Williams and Russell M. Wilder: "The Russian army is fed whole grain. Thus far it is the only army to match successfully the whole-grain eating army of the Nazis. The endurance of the Russian citizen equals the vigor of the Russian soldier. The Russian people eating whole-grain bread receive important nutrients denied to people who depend on ordinary white flour for their bread."

Nutrition Reviews, The Nutrition Foundations, Inc., Chrysler Bidg., N.Y.C., 2, Dec. 1942, page 61: "At present the governmental authorities in England have authorized (1) the production of a "national wheat meal" of 85% extraction, fortified with calcium carbonate, and

(2) the addition of thiamine to white flour."

Journal of the American Dietetic Association, April, 1942, "Why Enriched Bread?" by Robert R. Williams and Russell M. Wilder: "We have Investigated and found that almost every large baking concern has among its officers some man who has had his fingers burned in an attempt to promote the sale of whole wheat bread or like breads. Yet today less than two percent of all the flour sold is whole wheat flour. The widespread efforts to get people to cat more whole wheat bread have failed, because the public prefers the color, texture and flavor of white bread."

Federal Registers, Washington, D. C., Nay 27, 1941, June 5, 1943 and July 3, 1943: pages 2578, 7514, and 9116 respectively, (enactments and amendments by the Food and Drug addministration): Waterial is

arranged into a table by the compiler.

Optional

"Enriched Flour", so labeled and sold in the future, will have the following percentages of added ingredients, or if not—other percentages used will be specifically described on the labels: UNITS ADDED PER POUND OF FLOUR

	AS ATENT	DED, JULY	3, 1943	
	Minin	MUM	Faximu	n
Thiamin	2.0	mgs .	2.5	mes
Riboflevin	1.2	mgs	1.5	mgs
Niacin	16.	mgs	20.	mg 3
Iron	13.	mgs	16.5	mgs
(Caloium	500.	mgs	625.	mgs
(Vit. D.	250.	U.S.P.	1,000.	U.S.P.

Quoted from above source: "(d) it may contain not more than 5 percent by weight of wheat germ or partly defatted wheat germ; and (e) in determining whether the ash content complies with the requirements of this section allowance is made for ash resulting from any added iron or salts of iron or calcium. For and calcium may be added only in forms which are harmless and assimilable. The substances referred to in paragraphs (a) and (b) may be added in a harmless carier which does not impair the enriched flour; such carrier is used only in the quantity necessary to effect on intimate and uniform admixture of such substances with the flour."

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DIETARY HABITS IN VARIOUS COUNTRIES:

Time, August 31, 1942, Number 9, page 69, "Nonpoisonour Bread": "In countless articles Professor Sherman has crusaded against our eremy, the wheat loaf, backing up his written views with pictures of laboratory rats who when fed on white bread diet, lost their hair, teeth, whiskers, and eventually grew peaked and died. The 20% decrease in the per capita bread consumption by the U.S. during the past generations has been due partly to the growing emphasis on vitamins and protective foods, partly to the realization that both vitamins and minerals are lost when flour is refined to pure whiteness. As a result, only one-third of the food calories in the United States now come from bread (only 19% in the families of professional men), compared with 40% in most of Europe, 53% in France. Modern Bread, says Dr. Sherman, should bring the U. S. figure up to 40%. This means that two billion pounds would be added to the annual U. S. bread consumption. Professor Sherman recommends the "longer-extraction" of "whole-meal" flour which discards the coating, but utilizes about 85% of the wheat kernel. It is the basis of the British 'hational loaf'.

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FLOUR, GOVERNMENT REGULATION OF, Plain White Wheat:
and Plain White Wheat Enriched:

Federal Registers, Washington, D. C., May 27, 1941, June 5, 1943, and July 3, 1943; pages 2578, 7514, and 9116 respectively, (enactments and amendments by the Food and Drug Administration). "15.000 Flour, White flour, Wheat flour, plain flour - identity; label statement of optional ingredients. (a) Flour, white flour, wheat flour, plain flour, is the food prepared by grinding and bolting cleaned wheat other than durum wheat and red durum wheat; to compensate for any natural deficiency of enzymes, malted wheat, malted wheat flour, malted barley flour, or any combination of two of these, may be used; but the quantity of barley flour so used is not more than 25%. One of the cloths through which the flour is bolted has openings not larger than those of woven wire cloth designated "119 micron (No. 100)" in table I of "Standard Specifications for Sieves", published Warch 1. 1940. in L. C. 584 of the U. S. Department of Commerce, National Bureau of Standards. The flour is freed from bran coat, or bran coat and germ, to such extent that the percent of ash therein, calculated to a moisture-free basis is not more than the sum of one-twentieth of the percent of protein therein, calculated to a moisture-free basis, and 0.35. Its moisture content is not more than 15 percent. Unless such addition conceals damage or inferiority of the flour or makes it appear better or of greater value than it is, one or any combination of two or more of the following optional bleaching ingredients may be added in a quantity not more than sufficient for bleaching or, in case such ingredient has an artificial aging effect, in a quantity not more than sufficient for bleaching and such artificial aging effect: (1) exides of nitrogen, (2) Chlorine, (3) Nitrosyl Chlorine, (4) Mitrogen Trichloride, (5) One part by weight of benzoyl peroxide mixed with not more than six parts by weight of a mixture of either potassium alum or calcium sulfate and magnesium carbonate. (b) When any optional bleaching ingredient is used, the label shall bear the word "Bleached". Wherever the name of the food appears on the label so conspicuously as to be easily seen under customary conditions of purchase, the word "Bleached" shall immediately and conspicuously precede or follow such name, without intervening written, printed, or graphic matter; except that where such name is a part of a trade-mark or brand other written, printed, or graphic matter, which is also a part of such trade-mark or brand, may so intervene if the word, "Bleached" is in such Juxtaposition with such trademark or brand as to be conspicuously related to such name. (c) For the purpose of this section: (1) Ash is determined by the method prescribed in the book "Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists" 5th edition, 1940, page 212, under "Method I-Official". Ash is calculated to a moisture-free basis by subtracting the percent of moisture in the flour form 100, dividing the remainder into the percent of ash, and multiplying the quotient by 100. (2) Protein is 5.7 times the nitrogen as determined by the method prescribed in such book on page 26, under "Kjelkahl-Gunning-Arnold Nethod-Official". Protein is calculated

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FLOUR, GOVERNMENT REGULATION OF, Plain White Wheat:
and Plain White Wheat Enriched:

Federal Registers (continued)
basis by subtracting the percent of moisture in the flour from
100, dividing the remainder into the percent of ash, and multiplying the quotient by 100. (3) Moisture is determined by the
method prescribed in such book on page 211, under "Vacuum Oven
Method--Official".

15.010 Enriched flour - identity; label statement of optional ingredients. Enriched flour conforms to the definition and standard of identity, and is subject to the requirements for label statement of optional ingredients, prescribed for flour by 15.000, except that:

(a) (b) and (c) digested into table by compiler:
"Enriched" flour of the future will have the following percentages
of added ingredients, or if not--other percentages used will be
specifically described on the label:

			Ţ	mits	added	per pe	ound of Flour
		ENIA	CTED 1941			A'TINDI	20 1943
	Mir	imum	Vaxi	mum	Mn	imum	Vaximum
Thiamin	1.6	ob mgs	2.5	mgs	2.0	mgs	2.5 mgs
Riboflavin	1.2	ngs	1.8	mgs	1.2	mgs	1.5 mgs
Niacin	6.	mgs	24.	mgs	16.	mgs	20. mgs
Iron	6.	mgs	24.	mgs	13.	mgs	16.5 mgs
(Calcium	500.	mgs	2,000.	mgs	500 .	mgs	625. mgs
Optiona Wit. D	250.	U.S.P.	1,000 · U.	S.P.	250.	U.S.P.	1,000. U.S.P.

"(d) it may contain not more than 5 percent by weight of wheat germ or partly defatted wheat germ; and

(e) in determining whether the ash content complies with the requirements of this section allowance is made for ash resulting from any added iron or salts of iron or calcium. Iron and calcium may be added only in forms which are harmless and assimilable. The substances referred to in paragraphs (a) and (b) may be added in a harmless carrier which does not impair the enriched flour; such carrier is used only in the quantity necessary to effect an intimate and uniform admixture of such substances with the flour.

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COMPARATIVE TABLES CONCERVING "ENRICHMENT", DAILY REQUIREMENTS, ETC.

- *Taylor, Clara W., Food Values in Shares and Weights, MacWillan Co., N.Y.C., 1942, pages 2, 94, and 60:

 **Federal Registers, Washington, D. C., June 5, 1943--page 7514 and July 3, 1943--page 9116:
- I. Dietary Standards set up in 1941
 by the Foods and Eutrition Committee
 of the National Research Council:
 Recommended Daily Allowances for
 Man (70kgs.) Toderately Active:
- **Food and Drug Administration (1943)
 amended legislation (now effective)
 whereby Enriched flour of the
 future will have the following percentages of added ingredients, or if
 not--other percentages used will be
 specifically described on the label.
 Units Added Fer Pound of Flour:

				73	nimum	Maximum	
Calories	3000						
Protein	70	mgs					
Thiamin	1.8	mgs		2.0	mgs .	2.5	mgs.
Riboflavin	2.7	mgs		1.2	mgs	1.5	mgs
Niacin	18.0	mgs		16.0	mgs	20.0	mgs
Iron	12.0	mgs		13.0	mes	16.5	mgs
Calcium	800.0	mgs		(500.0	mgs	625.0	mgs
Vitamin D	400.0	U.S.P.	Optional	-(250.0	U.S.P.	1000.0	U.S.P.

II. *Food Values of Various Kinds of Bread:

Kind	Approximate leasure	Cal- ories	Fro- tein Gms.	Cal- eium Mgs.	Iron Mgs.	Vita- min A I.U.	Thia- min (B ₁) Mgs.	Ascor- bic Acid (C)	Ribo- flavin (G) Mgs.
white (water)	1 slice, 3"	50	1.3	5	0.18		top	lgs.	-
whole wheat 50%	1 slice, 3"	55	1.3	8	0.33	*	0.039	-	0.017
whole wheat (100% water)	1 slice, 3" z 3/4" z 3	75	3.0	15	G.84	*	0.084	-	0.026
white enriched (some milk)	1 slice, 4" x\forall 3/4 x\forall 1	60	2.0	11	0.40	•	0.056	~	0.016

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"ENRICHT ", History of:

How to Use Bread in Modern Meals, Zinsmaster Baking Co., 1942, (our files C-221); pare 4: "Enriched white bread was first produced in 1941, at the behest of the Food and Mutrition Committee of the Mational Research Council. To insure uniformity of enrichment of white bread, the U.S. Food and Drug Administration has indicated legal, official daily requirements for most of the vitamins and minerals contained in it."

Tutrition Boviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., 2, Dec. 1942, page 61; "At present the governmental authorities in England have authorized (1) the production of a "national wheat meal" of 85% extraction, fortified with calcium carbonate, and (2) the addition of thismine to white flour. It would be inadvisable however, for the reasons given, to apply the conclusions of the British investigators to conditions elsewhere, or to accept the conclusions with out reservation."

Journal of the American Dietetic Association, April 1942, (Vol. 18, No. 4),

"Why Enriched Bread?", by Williams and Wilder: "In contrast to
the poor acceptance by consumers of whole wheat bread, our investigation shows that about forty percent of all the family flour on
the market and more than a third of all baker's bread has been enriched. We owe this fine achievement mainly to the millers and the
bakers, who have gone ahead with little help thus to improve the
nutritive quality of white bread. They have done this in the
interest of the public health. They began to make enriched bread
and flour in February 1941, at the time of a pronouncement on the
subject by the Committee on Food and Mutrition of the National
Research Council. The committee is a body of scientists and physicians
serving as advisors to the government in the national emergency.

"But forty percent of all the flour and a third of all white bread is not enough to have enriched. The low-priced flours on the market are not enriched, and it is these flours that are eaten by people whose diets most need improving. All flour and all white

baker's bread should be erriched."

Bakers Weekly, American Trade Publishing Co., N.Y.C., September, 6, 1943,

"The Importance of Bakery Products in the War Food Program", by
Robert R. Black, Assistant Chief, Grain Products Branch, Food
Distribution Administration: "Bakers at the present time are making
their enriched bread by the addition of tablets, by the use of
enriched yeast, and also by the use of enriched flour. It is expected that on Ostober 1 the higher level of enrichment required
by the regulation under the Food, Drug and Cosmetic Act will be
effective.

"On July 21 a public conference was held in Washington to determine the best means of securing a wider distribution of enriched bakery products, including those made in the homes and in hotels, restaurants, and institutions as well as those made by commercial bakers. Persons unable to attend the conference were invited to write us regarding their opinions. So many letters, telegrams, and briefs were filed in response to our invitation that we were unable to complete the digest of this information until last week. The information is now being studied

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"Enrichment", History of:

Bakers Waekly (continued)

to determine what method or combination of methods will accomplish the objective. We believe that the bakers deserve an early decision, and it is hoped that a decision can be reached some time in September."

Federal Register, July 3, 1943, page 9116: It states that enriched flour of the future is to have the following percentages of added ingredients, or if not that other percentages must be given on the label:

	Unit	s add	bef	per	Pound	of Flour
	"ini	mum			M	aximum
Thiamin	2.0	mgs			2	·5 mgs
Ribeflavin	1.2 :	mgs			1	.5 mgs
Njacin	16.	mgs			20	• mgs
Iron	13.	mgs			16	·5 mgs
Calcium 50	00.	mgs		a a	. 625	· mgs
Vit. D 29	50.	USP			1,000	. USP

"The regulations hereby promulgated shall become effective on the ninetieth day following the date of publication of this order in the FEDERAL REGISTER. Dated: July 1, 1943.

Watson B. Miller Acting Administrator Food and Drug Administration

Food Field Poporter, October 16, 1943, page 23; "Marx Assatls Compulsory Bread Enrichment", Milwaukee: "The compulsory enrichment of bread was declared to be an invasion of American democratic principles in an address by Victor E. Marx, in charge of the bakery division of the American Milk Institute, before the recent annual convention of the Wisconsix Bakers Association. Thile approving the bakers' almost unanimous opposition to the recent government proposal which would have made the use of enriched flour the only acceptable method of enrichment. Mr. Varx felt the bakers had not gone quite far enough.

"Peculiarly, in the thinking of bakers, "MR. Marx stated, "while they saw in this proposal a threat to their democratic freedom to choose their own method of enrichment, they did not see in the compulsory enrichment of all white bread the loss of freedom of choice

of the consumer for the kind of bread she desires."

"In the opinion of Fr. Mark, compulsory enrichment is unsound, because "the proof of great superiority of enriched bread is very difficult to find." For example, he claimed, "it can be clearly shown, by scientific feeding tests on experimental animals that unenriched bread containing 6 percent of non-fat-milk solids will support growth far better than enriched bread not containing milk."

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"ENRICHED" DEFINED, Flour Enrichment vs. Bread Enrichment

Sherman, W. C., and Caroline S. lanford, Essentials of Mutrition, MacVillan Company, N.Y.C., 1943, page 209: "Enriched' is the term authorized by the United States Food and Drug Administration to designate a white or near-white flour or bread which contains specified amounts of thiamin (and of such other things as may be prescribed by Federal regulation) whether this enrichment be effected by one or another of the three plans just mentioned* or by combining them with each other or with new methods of milling which produce white or near-white flours of the ordinary roller-mill process."

Wilder, Russell N., Chief, Civilian Food Requirements Branch, F.D.A., War Food Administration, Washington, D. C., July 21, 1943: Concerning enrichment of bread versus enrichment of all white family flour, he said: "However I feel strongly that the second procedure** is basically the sounder." "The number of bakers is so large, roughly 30,000 many of them small, that the problem of obtaining full cooperation is extremely difficult." "Thus the practical advantages of enriching all flour flour are very great."

Cooper, Barber, and Mitchelly Mutrition in Health and Disease, J. B. Lippincett, Philadelphia, 1941, page 500: "Enriched bread may be made from "enriched flour or by the use of special yeasts; by the addition of vitamin concentrates or by a combination of these methods. The standard for vitamin and mineral content of the bread is about two-thirds that of the flour to allow for lesses in cooking and for the fact that bread is not all flour."

Nutrition Division of the Office of the Federal Coordinator of Health, Welfare, and Related Defence Activities, 20 Questions on Enriched Flour and Bread, 1941: "1. What is enriched flour? White flour plus thiamin, nicotinic acid, and iron."

The replacement of the thiamin, so as to bring white bread to something approaching a whole-wheat level in this respect, can now be done in any of three ways: by returning wheat germ in the making of the bread; by the use of a specially developed high-vitamin yeast; by adding pure thiamin to the white flour when milled."

^{**}Meaning that of enriching all white family flour.

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"ENRICHED" DEFINED, Flour Enrichment vs. Bread Enrichment

Transcript of Discussion on "Enriched" Bread and Flour, held at the
National Federation of American Bakers and Millers Conference
which met in Chicago, Ill., March 5, 19hl; Consumers Section,
page 12, Miss Gladys Hall, Educational Director of the American
Dietetic Association: "Of course, our first concern is to provide an adequate diet for all groups in some way. The enriched
bread undoubtedly will help many groups but there certainly is the
question of the Southerners' eating habits. We are inclined to
think of the Southerners' diet in terms of cornbread, perhaps. On
the other hand, they do consume large quantities of biscuits and
that type of thing.

Bakers Weekly, American Trade Publishing Company, N.Y.C., September 6, 1943.

"The Importance of Bakery Products in the War Food Program", by
Pobert H. Black, Assistant Chief, Grain Products Branch, Food
Distribution Administration, page 34: "Bakers at the present time
are making their enriched bread by the addition of tablets, by the
use of enriched yeast, and also by the use of enriched flour. It
is expected that on October 1 the higher level of enrichment required by the regulations under the Fcod, Drug and Cosmetic Act

will be effective."

The Journal of Nutrition, June 10, 1943, "The Contribution of Non-Fat Milk Solids to the Mutritive Value of Wheat Breads", by Mitchell, Hamilton, and Shields, page 601: "The incorporation of non-fat milk solids in white bread to the extent of 6% of the flour improves the growth-promoting and bone calcifying values of the bread much more than does its enrichment with thiamine, nicotinic acid and iron. The "Enrichment" of white bread containing skim milk solids does not further improve its capacity of promoting growth, but it does, if only slightly, induce a greater concentration of hemoglobin in the blood."

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Transcript of Discussion on "Enriched" Bread held by American Bakers and Millers in Chicago, Ill., March 5, 1941, page 11; Dr. Toby, Dir., Dept. of Mutrition, American Inst. of Baking: "If your bread is enriched it contains thiamin, Micotinic acid and riboflavin, you have the essentials from the nutritional point of view. You don't need to think about pantothenic acid, pyridoxine, and perhaps some other slightly known components of the B complex."

Report by the Food Research Laboratories, Inc., 114 E. 32 St., N.Y.C., 1941,

Table III:

"LABORATORY TESTS TO DETERMINE THIAMINE LOSS DURING BAKING

Air Dried Samples	Thiamine Content I. U. Per Lb.	Thiamine Destroyed by Baking, percent
Basal bread Enriched bread Enriched bread Enriched bread Enriched bread Ahole wheat bread	113 465 (with yeast 381 (with mg.tablet 353 (with mg.tablet 656	26 15 21 9 13 6 "

Journal of the American Dietotic Association, April, 1942, "Why Enriched Broad?" by Robert R. Williams and Russell M. Wilder: "The Russian army is fed whole grain. Thus far it is the only army to match successfully the whole-grain eating army of the Nazis. The endurance of the Russian citizen equals the vigor of the Russian soldier. The Russian people eating whole-grain bread receive important nutrients denied to people who depend on ordinary white flour for their bread. "Most people simply cannot be persuaded to eat whole wheat. Bocause of the over-refinement of white flour, physicians for a hundred years have urged the use of whole wheat bread. In spite of the doctor's advice, in spite of similar teaching by nutritionists, people continue to refuse to eat the dark breads recommended. "Why? Some people think the millers and bakers are responsible. They say that people would eat whole wheat or undermilled dark bread and use whole wheat flour in their cooking if the millers and the bakers would provide such products. Nothing could be further from the truth. Whole or partly whole wheat breads can be bought in almost every bakery. The millers have every commercial reason for wishing to sell the whole of their grain as flour if they could do so. The bakers, we have learned, make whatever the public wants. Wheat farmers have a motive for promoting the continued use of white flour as nearly a third more wheat is required to make a barrel of white flour than one of whole wheat flour. However, it is not apparent that their voices have been influential in this matter. Repeated efforts have been made and millions of dollars have been spent by the milling and baking industries to popularize dark breads; all without success. We have investigated and found that almost every large baking concern has among its officers some man who has had his fingers burned in an

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Whole Grain Flour, Pro and Con:
Amount of Willing Nost Desirable:

Journal of the American Dietetic Association (Continued)

attempt to promote the sale of whole wheat bread or like breads.

Yet today less than two percent of all the flour sold is whole wheat flour. The widespread efforts to get people to eat more whole wheat bread have failed, because the public prefers the color, texture and flavor of white bread."

Mutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C.,
March 1943 (Vol.1, Number 5), page 132: "The experiment showed
that 10.5 grams of the proteins of whole wheat were as useful to the
rat as 13.1 grams of white flour proteins. Other arrangements of
the data obtained, for example the calculation of the amount of
protein in the food required for each gram of weight gained, showed
that the biologic value of the proteins in whole wheat flour was
superior to the biologic value of the proteins in white flour.

"These investigators pointed out that the slight difference in
digestibility favoring white flour is more than compensated for
by the greater biologic value of the national wheat meal or by the
whole wheat meal in the promotion of growth. Further, the
animals receiving whole wheat meal and national meal consumed more
food than the animals receiving white flour."

Food Field Reporter, N.Y.C., Sept. 6, 1943, "Proteins of Whole Wheat

Surpass White Flour", page 24: "The Biclogic value of the proteins
in whole wheat flour was found to be superior to that in white
flour in studies done by Chick and reported in the English Journal
"Lancet". His work was commented on in a recent issue of

"Nutrition Reviews".

"Experiments showed that 10.5 grams of the proteins of whole wheat were as useful to the rat as 13.1 grams of white flour proteins.

"In two experiments it was found that 87.9 and 86.8 percent of the protein in white flour was digested and absorbed as compared to 85.4 and 86.6 in national wheat meal (an officially approved high extraction flour) and 83.2 and 81.7 in whole wheat meal. This investigation pointed out that the slight difference in digestibility favoring white flour is more than compensated for by the greater biologic value of the national wheat meal or by the whole wheat meal in the promotion of growth."

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MOLE GRAIN FIGURE, Pro and Con:
Amount of Milling Most Desirable:

Sherman, N. C., and Caroline S. Lanford, Essentials of Nutrition, MacMillan Company, N.Y.C., 1943, page 226: "Whole wheat contains only about one-fourth as much riboflavin as thiamin. The germ of embryo is richer in both of these factors than is the entire grain. But asthe germ constitutes only about two percent of the weight of the grain a large fraction of both thiamin and riboflain of wheat is rejected with the bran, even if the germ is retained with (or returned to) the white flour."

page. 355: "To provide more fully for thiamin (vitamin B1) and iron, we have recommended also that of such amount of breadstuffs or cereals as one may choose to eat, at least half should be in the approximately "whole grain" forms; and we now add, "let all white bread be enriched"."

Williams, Pobert R., and Tom D. Spies, Vitamin B, and Its Use in Medicine, MacMillian Co., N.Y.C., 1938, page 232: "In flour of 60% extraction, Schounert found no thiamin; flour of 75% extraction retained 40% of that of the whole grain; of 82% extraction, 60% of that of whole grain. This method was again the rat protective one."

Sherman, H. C., and Constance, S. Fearson, Modern Bread, Wackillan Co., N.Y.C., (389.1 Sh5M) page 41: "Rose and Vahlteich (1932) found the iron of whole wheat and of bran, as elso of catmeal, to be effective in hemoglobin formation. Patent flour also festered hemoglobin to some extent; but patent flour with added ironwas not so effective as the same total amount of iron in the form of whole wheat. They concluded that either the iron in catmeal and whole wheat is more effective than that of white flour enriched with iron, or that the whole-grain products contain something else as well as iron which is favorable to the assimilation of iron and the formation of hemoglobin."

Annual Review of Biochemistry, Stanford University, 1943, (381 An7 vol.12), page 259: "Widdowson and McCanee found that iron was well absorbed from a diet in which white flour bread constituted 40 to 50 percent of the calories. Iron was less efficiently absorbed, however, from similar diets when the white flour was replaced with a flour of 92% extraction." from: Widdowson, B. M., and McCanee, R. A., Lenest, 1, 588-90 (1942)

Nutrition Reviews, The Nutr. Foundations, Inc., Chrysler, Bldg., N.Y.C., 5, March 1943, page 131: "Two reports show conclusively that whole wheat flour is digested almost as completely as white flour, and that its proteins are of higher biologic value. There is thus no objection and some advantage in the substitution of whole wheat flour for white flour, but other considerations lead to the conclusion that such a step by itself will not solve the problem of maintaining the general protein content of the diet."

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WHOLE GRAIN FLOURS, Pro and Con
Amount of Milling Most Desirable:

Wilder, Russell M., Chief, Civilian Food Requirements Branch, F.D.A., War Food Adm., Washingto, D. C., July 21, 1943: "For the reasons given, extensive use of whole-grain and under-milled flours or of mixtures of white flour with legumes is judged unde sirable as a reans of correcting the inadequate supply of thiamina, misein, and iron when the flour used is plain white flour." He states that the objections are: 1. Under-milling of flour will encounter consumer resistance which may result in lowering the intake of calories. 2. "A second objection to large-scale use of whole-wheat or undermilled flour is that such practice would divert the mill streams containing the bran coats of the wheat now going to animal feed, and diversion of this very important part of the supply of animal feed would result in undersirable curtailing of present meat and milk production. Deeds for livestock are in short supply." 3. "A third objection is that the keeping qualities of whole-grain flours and under-milled flours are poor as compared with white flour with resulting deterioration in hot climates such as prevail in the U.S. in the summer seasons." 4. "Finally, for a definite proportion of the population including many persons who are invalides, flours containing much bran or other roughage are sufficiently irritating to the bowles to be unacceptable."

Nutrition Division of the Office of the Federal Coordinator of Bealth, Welfare, and Related Defence Activities, 20 Questions on Enriched Flour and Bread, 1911, "10. Should enriched bread be used in place of whole wheat? No. If you prefer white bread be sure it is enriched."

Sherman, Henry C., and Tearson, Constance S., Modern Bread, MacWillan Co., N.Y.C., 1942, (329.1, Sh5M), page 50: "According to a report in the Lancet for August 3, 1940, the joint committee of the Lister Institute and the Vedical Research Council recommended: (1) that wheat be milled to yield not less than 80 to 85 percent of its weight as flour." Pages 48-49: "And as the ordinary milling process of recent decades has excluded about four-fifths to nine-tenths of the thiamin of wheat from the bread flour, thiamin has been the nutrient first and most prominently considered in recent movements to enrich white flour and bread. Copping (1939) concludes that whole wheat contains an average of 5.58 micrograms of thiamin per gram, and correspondingly flour of 82% extraction, 3.00, and . . . of 60% extraction, 0.72 micrograms per gram. This would mean only about one-fifth as much thiamin in straight-run flour and only about one-eight as much in patent flour as in whole wheat. On the other hand, when wheat is so milled that 82 to 95 percent or more of the weight of the grain is recovered as bread flour, such a flour can be free from harsh fiber and can be capable of yielding a strong dough and a bread of light texture, while at the same time it may contain the greater part of the thiamin of the grain and at least four times as much thiamin as is contained in the patent and other low-extraction flours chiefly used for breadmaking during the past two decades.

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WIGLE GRAIN FLOURS, Pro and Con:
Amount of Willing Wost Desirable:

Nutrition Reviews, The Mutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Iov., 1942, 1, page 11: "Fifty samples of milled patent and clear flours indicate that the milling loss of riacin, pantothenic acid, and pyridorine is approximately 83, 57, and 52 percent respectively for patent flour and 64, 28, and 15 percent respectively for the first clear flour.

. . "Thus we know that thismine, riboflavin, and pyridoxine are concentrated in the germ portion of the wheat but niacin and pantothenic acid are not. The addition of small amounts of the germ to flour would not be an effective means of raising the concentration of the latter two vitamins in flour or bread, and it would appear that the nutritional improvement given to bread by including 5 percent of germ cannot be attributed to the addition of these two members of the B-complex." from study by Tepy, Strong, and Elvehjem

(Journal of Nutrition 24, 167 (1942))

Discussion on "Poriched" Bread held by American Pakers and Millers in Chicago, Ill., March 5, 1941 (transcript of), page 5; Dr. Wilder: "The Ministry of Foods vesterday announced arrangements with millers and bakers for immediate production of whole meal flour and bread, 85% extraction, in quantity sufficient to meet all demands and at the same wrice as white bread. Eight-five percent extraction selected as maximum digestibility and nutriment."

page Ih; Dr. J. A. Tobey, Director, Dept. of Nutrition, American Institute of Baking: "Mr. Williams, Dr. Shovholt asks if it is possible and if it is proper to designate the minimum levels of Enriched Bread as meeting the whole wheat level or standard. I don't think it is and I believe that Dr. Faily agrees with me. We hope perhaps to be able to set forth what seems to be the consensus of opinion of the levels in whole wheat, at least within low and high levels of the whole wheat bread, so many milligrams of iron, etc., so that you can see from that whether the standard you have in your bread is approximately equal to whole wheat or whether it isn't, whether it is below it or whether it is above it. It is a rather difficult thing to set. However, we will try to doso."

consumer's section, page 2; Dr. Felen 'itchell, Nutr. Consultant to the Coordinator on Health Problems: "Another thing that Mrs. Consumer is worried about is the question as to whether this now bread it to replace whole wheat bread which her family happens to have liked. Now, we allknow that it is a very small percentage of our total consuming population that uses whole wheat products. Some of our nutrition people have been trying to persuade them to do that for a long time but it is the 98 percent who have not been using those whole wheat products for whom this program is primarily aimed. But it is the vociferous and audible 2 percent who are concerned as to how it is going to affect the users of whole wheat. I think we can give them some comments that will sase their minds."

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WHOLE GRAIN FLOURS, Pro and con:
Amount of Milling Wost Desirable:

The Journal of Nutrition, June 10, 1943, "The Concentration of Non-Fat Milk Solids to the Nutritive Value of Wheat Breads", by Mitchell, Hamilton, and Shields (Univ. of Ill.), page 601: "For the purposes of growth, skim milk solids is a better supplement to white flour than the residue of the wheat berry discarded in its milling, though a combination of the two supplements is better than either alone. There is something in whole wheat, as compared with patent white, flour that impairs calcium utilization. Enriched white bread with skim milk solids is the equal of whole wheat bread in the promotion of growth and in the production of blood hemoglobin and is distinctly superior to it in the promotion of bone calcification."

Cereal Chemistry, May, 1943, Vol.XX, No.3, page 329, "The Manganese Content of Bread and Wheat Products", by Hoffman and Dalby of Ward Baking Co., N.Y.C.,: "Manganese and ash are closely related factors. A manganese determination on enriched bread is often useful in judging the type and grade of flour used in its manufacture. Whole wheat flours average 35-40 micrograms of manganese per gram, whereas standard patent flours average about 4 micrograms per gram."

The Journal of Nutrition, October 11, 1943 (389.8, J82), "Some Results of Feeding Rats a Fuman Diet Low in Thiamine and Piboflavin", by Higgins, Masch and Gatz (Mayo Foundation), page 347: "Five diets differing from one another only in the flours from which the bread component was made, were prepared. Supplementations of patent white flour with thiamine, riboflavin and miacin, while improving the growth rate of the rats, were not adequate to secure weights attained by animals eating the diet that contained whole wheat flour. . . Fortification of the flour used in the bread component of the low thiamine-low riboflavin human diets with thiamine, riboflavin and miacin in the amounts proved inadequate to promote satisfactory growth or to prevent pathologic changes in the livers, thyroids and pituitary glands of white rats."

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"EMRICHMENT", Nutritional Need for:

Annual Review of Biochemistry, Stanford University Press, Vol.12, 1943 (361 An7 V.12), page 324: "Studies of the thiamin content of the average American diet have revealed that before the advent of enriched bread it contained about 0.8 mg. per 2500 cal. Enrichment of all flour and bread would raise this value to 1.3 mg. Iean pork, bread, and milk are the principal contributors of thiamin to the diet." From: Iane, R. L., Johnson, E., and Williams, R. R., Jeurnal of Nutrition 23, "613-2h" (1942).

"One the basis of extended studies on induced thiamin deficiency in human beings, the minimal requirement is set at 0.55 mg. per 2500 cal. and for maintenance of efficiency 1.25 to 1.5 mg." From: Williams, R. D., Mason, H. L., Smith, B. F., and Wilder, R. M., Arch, Internal Med., 69, 721-38 (1942).

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Building, I.Y.C., April, 1943, 6 page 175: "Intestinal organisms isolated from man have been shown to synthesize thiamine, riboflavin, niacin,

and biotin (Nutrition Reviews 1, 4 (1942))."

Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Bldg., N.Y.C., Dec. 1912, 2, page 59: "Yet nutritionists long have pointed out the superior nutritive value of whole wheat as compared to its milling products, particularly patent flour. According to reports in the literature, average whole wheat flour-from hard winter wheat-provides in each 100 g. about 0.45 mg. of thiamine, 0.25 mg. of riboflavin, 6.0 mg. of nicotinic acid, 53 mg. of calcium, and 3.9 mg. of iron. An equal amount of white flour on the other hand provides about 0.05 mg. of thiamine. 0.04 mg. of riboflavin 0.8 mg. of nicotinic acid, 16 mg. of calcium, and 1.0 mg. of iron."

Sherman, H. C., and Constance S. Pearson, Modern Bread, MacMillan Co., 1942, (389.1 Sh5M), page 45: "Stone-ground wheat flour "of our grandparents" is estimated to have contained about 60 percent of the thiamin in the wheat. In contrast, the white flour produced by the roller process is reported to contain only 6 to 16 percent. No longer are we justified in ignoring this difference on the assumption that, in the diversified diets of this country, enough thiamin will always be

supplied from other sources."

The Journal of Nutrition, October 11, 1943 (389.8, J82), "Studies of the Average American Diet", by Cheldelin and Williams (Univ. of Texas), page 417: "The riboflavin, nicotinic acid and pantothenic acid contents of the average American diet, such as was consumed by the middle two-thirds or three-fourths of the population prior to the use of enriched bread and flour, are approximately 1.4 mg., 11 mg, and 4.9 mg., respectively, per 2500 calories. These values are appreciably lower than the most generally supposed daily requirements. . Enrichment of bread and flour to meet prevailing standards increases the level of riboflavin, 12% to 1.6 mg.; that of nicotinic acid, 53% to 17 mg. The principal contributors of these vitamins to ordinary diets are as follows in the order of their importance: for riboflavin, milk, white bread, eggs, potatoes and liver; for nicotinic acid, beef, lean pork, fish, white bread and potatoes; for pantothenic acid, white bread, milk, eggs, and potatoes."

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"ENRICHMENT", Mutritional Need for:

Wilder, Russell ., Chief, Sivilian Food Requirements Branch, F.D.A., Mar Food Administration, Washington, D. C., July 21, 1943: "Wheat for several years has contributed approximately one-fourth of the calories of the average diet of the civilian population of the United States." "White flour constitutes more than 95% of the milled wheat products used in the human diet." "White flour is deprived, by the nature of its manufacture, of from 80 to 90 percent of the micro-nutrients thismine, miscin, and iron contained in the wheat from which it is made."

Wilder, Russell M., Jan., 1943, Vitanin B, (Thiamine), Annals of the American Academy of Political and Social Science, 225, (280.9 Am34), page 29: "White patent flour retains little more than a tenth of the thiamine in wheat; and bread makes up a sizable fraction of the average diet." "Basing calculations on the disappearance of food products of human consumption in the United States, Lane and co-workers * conclude that the total provision of thiamine does not exceed an average of 0.32 mg. per 1,000 calories. This figure equals that defined by the United States Food and Drug Administration as the minimal dialy adult requirement necessary to prevent actual disease. The minimal daily requirement to prevent biochemical abnormality, as determined by Williams and co-workers, is 0.45 mg. per 1,000 calories. The allowance recommended by the Food and Nutrition Board of the National Research Council is 0.6 mg per 1,000 calories. If the average person receives only 0.32 mg. per 1,000 calories, it should be obvious that millions of our population are suffering from actual deficiency disease and that relatively few diets provide enough thiamine for full health and efficiency."

Batchelder, Esther L., Jan. 1943, Riboflavin, Annals of the American Academy of Political and Social Science, 225, (280.9 Am. 34), page 32: "Reports of widespread occurance of riboflavin deficiency disease, diagnosed by qualified observers, indicates that the diet of many Americans is too low in this factor. Milk, liver, kidney, and eggs are generally recognized as dependable sources of this factor. Whole - grain cereals are not very rich on a weight basis, butif used instead of refined products, can appreciably increase the intake of this vitamin."

Elvehjem, C.C., Jan., 1943, "The Newer Members of Vitamin B Complex," Annals of the American Academy of Political and Social Science, 225, (280.9 Am34) page 35: "Meat, milk, vegetables, and cereals are all good sources of pyridoxine and pantothenic acid, and less than one-half of the original amount of these factors present in the whole cereals is lost during milling, in contrast to a loss of 90 percent for thiamine and niacin."

*R.L. Lane, Elizabeth Johnson, and R.R. Williams, "Studies of the Average American Diet. I. Thiamine Content", Journal of Nutrition, 23: 613-24,

June 1943.

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ENRICHMENT OF FLOUR: How:

Wilder, Russell 1., Chief, Civilian Food Requirements Branch, F.D.A., War Pood Adm., ashington, D.C., July 21, 1943: "Provision of satis actory quantities of thiamine, niacin, riboflavin, and iron by under-milling wheat or by additions to white flour of soyheans, cottonseed or other legumes, in the quantities necessary to provide the required amounts of these nutritional factors, yields flours that are less satisfactory for many purposes from the standpoint of cooking quality, appearance and taste. Such flours encounter consumer resistance. And if consumer preference for white flour is ignored. there is reason to expect that wheat will be consumed less freely with resulting lowering of the intake of calories. This would lead to loss of weight and loss of strength."

F.D.A., War Food Adm., Abstract of Proposed Food Distribution Order Requiring Enrichment of All White Family Flour, July 2, 1943: "1. Provisions: Except as hereinafter indicated, no miller, blender or other person who manufactures or prepares white flour for sale for human consumption may sell or deliver the same unless it conforms to the amended definition of "Enriched Flour" contained in the proposal under the Federal Food, Drug, and Cosmetic Act, published in the Federal Register of June 5, 1943, pages 7511 - 7514. (The amended definition describes enriched white flour as containing in each pound not less than 2.0 milligrams of thiamire, 1.2 milligrams of riboflavin, 16 milligrams of njacin of niacine amide, and 13 milligrams of iron. Calcium and vitarin D remain optional ingredients as heretofore."

Federal Register, June 5, 1943, Food and Drug Administration, F.S.A., Enriched Flours and Parine, Amendments to Definitions and Standards of Identity. The following are reasonable limits, expressed as milligrams per pound, for thiamine, niacin, and iron as required ingredients in enriched flour, enriched bromated flour, and enriched self-rising flour. Thiamine, 2.0 to 2.5; Niacin, 16.0 to 20.0; Iron, 13.0 to 16.5. A reasonable maximum limit for riboflavin as a required ingredient in enriched flour, enriched bromated flour, and enriched self-rising flour is 1.5 milligrams per pound. A reasonable maximum limit for calcium as an optional ingredient in enriched flour and enriched bromated flour is 625 milligrams per pound, and reasonable minimum and maximum limits for calcium as a required ingredient in enriched self-rising flour are, respectively, 500 and 1500 milligrams per pound.

Transcript of Discussion on "Enriched" Bread and Flour, held at the National Conference of American Bakers and Millers in Chicago, Ill., March 5, 1941; Dr. Bailey: "It is my understanding, although this should be checked by Counsel, that bread made with materials such as soy bean flour is not covered by the definition of "Enriched Bread", and therefore is somewhat cutside of the general tenor of this particular conference. I assume that if such bread became sufficiently common, a special standard might be devised to fit the situation, but it is my opinion at the moment that the definition of "Enriched Bread" does not cover a mixture of flour and soy bean flour. I would be glad to have the council check that." (page 7)

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ENRICHMENT OF FLOUR, How:

Food Field Reporter, October 4, 1943, "Urge to Allow Soy in White Bread", page 24, Cedar Rapids, Iowa--"At the War Food Administration's request, the soybean industry has increased its soy flour producing capacity to 1,750,000,000 pounds. Now in view of the recent Food and Drug Administration's proposal to bar the use of soy flour (except up to one-half of 1% as a bleaching agent) in 'enriched white bread", the industry feels that at worst, it has been double-crossed, and that at best it is confused. Secretary George M. Strayer, Hudson, Ia., in his report to the recent American Soybean Association's wer conference here said that the association will fight to change this view."

Food Field Reporter, October 18, 1943, page 32, "Bread Standards Would not Outlaw Soy Flour", Washington: "There is nothing in the recently proposed bread standards to outlaw the substantial use of soy flour in special bread formulas, W. G. Campbell, commissioner of foods and drugs, recently stated in a letter to George M. Strayer, secretary of the American Scybear Association. However, the administration felt that the addition of merely 3% of soy flour to bread—the highest percentage proposed by any witness at the bread hearing—would not be a significant nutritional contribution, it

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"ENRICHMENT", Defraying Cost Of:

Transcript of iscussion, on "Enriched" Bread, held by American Bakers and Millers in Chicago, Ill., Parch 5, 1941, page 12; Mr. Harold West (Consumers Conference): "I think you might think, as consumers, which way you think would be the best way to bring that out for the masses, because those of us who went to help in this program, I believe, are thinking in terms of the masses, not in terms of the few. I personally do not expect that any baker will charge a premium for the enriched loaf. After all, it is only a question of 40 cents a barrel on flour and the four time to time that much, at any rate, and it will just kind of go in the general cost and when the cost gets high, somebody will put the price up and somebody else will follow; and when it goes down, somebody will cut and others will follow."

page 12 (Regular Conference); Chairman Williams: "There is another part of that same question, which I will try to answer myself, and perhaps Wr. Faker will want to join in. Why conceal the fact from the public that enrichment involves extra cost? I don't believe anybody has tried to conceal that fact. I have seen some advertising to the effect that "we have extra value at the same price; we are giving extra value at the same price." Mr. Faker, Vice Pres. of the Villers National Federation: "I think I agree with you thoroughly. Of course there are added costs, but the general emphasis is to get this new type of food to the people who need it most, and that is the people in the low income groups, and, naturally, the effort will be made to keep the cost down."

page 6 (Consumers Division); Pr. Fitchell, Nutrition Consultant to the Coordinator on Health Problems: "In some certain localities specially milled products have been made into breads that were selling at a tremendous premium and that question has come up recently, "Is this to sell at twice the price of ordinary bread?" and I have assured then that if there was any increase, it would be very, very slight, a matter of a cent, perhaps. But there is that fear that it is point to be sold at a high premium which, of course, would defeat

its purpose for the low income group."

page 6 (Consumers Division); Mrs. Clara G. Snyder, Director of Foods and Lutrition of the Wheat Flour Institute: "I would like to ask an opinion of Mrs. Leavens. Mrs. Leavens, suppose we said we didn't know what the price of this bread would be, whether it would have to be advanced or not, but suppose the bread did have to cost the consumer a cent a loaf more. What effect do you think that might have on Mrs. Homemaker's interest in this bread? Mrs. Leavens: "I think it might reduce the consumption of bread. K don't know for a certainly, of course, but the effect of increasing the price of milk, for instance, has certainly had an effect. Even an increase of one cent a quart has reduced the consumption of milk. Whether the two can be compared, I cannot say."

Lange made to a transfer a delice a color of the state of the color of respondent and the source of t thought wind out the resident of the form into the contract of ter s of the lim. I myrequelly do not exheet that any laker will des se medica de la principa l'est. Arten 133, in ta onle a autimont seductor fifte and in formally to the original safe as op to this the state of a to the the of the firm interpolation and the start of the former the property of the same than the same at engine the first entail forms to be a section of Tours of get filted fasts, officers mes the south of the Egennon with the total to a series where the series of the companies of th I fitnes profes territore to the trainer + do the git of the total The said I show he will be about the said of the man in the said. est in the automorphism of the feel and the state of the the court been an expert of a continue of the of refer of order of the order or and the second of the order of ्रित्रक इकारावृत्ति । एत्राप्ति इत्तरी (तिम १ विचार्त कर्ती) वृत्ते चलान्ति व उत्तर विचार् ೆ. ಗರಣ ಸೀತರ ಕಡೆದೆ ಡರಲ್ ನಗೆ ನಿರ್ವಾತ ಕ್ಷೇತ್ರಾತ ನೀತ ನಿರ್ವಾತಿ ನೀತ ನಿರ್ವಾತಿ ನೀತ ನಿರ್ವಾತಿ ನೀತ ನಿರ್ವಾತಿ ನೀತ ನಿರ್ವಾತಿ ನೀಡು ನಿರ್ವಾತಿ ನಿರ್ವಾತಿ ನೀಡು ನಿರ್ವಾತಿ ನೀಡು ನಿರ್ವಾತಿ ನೀಡು ನಿರ್ವಾತಿ ನಿರ್ವಿ ನಿರ್ವಾತಿ ನಿರ the control of the person to some out of the stage e seit villi veilt de itti bee milt into breide that ere ieli et inthoopy of the first on the second of the orey Ten Signif province on animal in the first time Author for at touch to the sections as a second to be a second and a second to be to the sent part of the first that they bear that the the the work with st. To go sent ereal of the or same of the same of the of the first in the literal work term of the me er Bita or savare, Patrick and and the committee of the c Elmow it to begin and though a out at the action of the ten of the would tard this to the area of the area of the state of the sta andal and There I also as go as well to are also a constant of the morning of the first of the ්ට ඉහරිකද මුත්ව ලදී අතුලතුරේ උත්තුල ලද යන නම් වෙන මුතුම මුතුම wedge " . The Sound library as of looks we will be a sound to

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"ENRICHMENT", Defraying Cost of:

Bakers' Weekly, October 4, 1943, "Enriched Flour Cost Ceiling" (page 33):

As reported previously in our pages, the new and higher levels of enrichment for flour labeled "enriched" became effective on October 1st. The Office of Price Administration has taken cognizance, and has issued amendment 8 to MPR 296 which permits millers and blenders of enriched flour to charge an additional 7 cents per hundredweight over the present premium of 10 cents per hundred-weight over ceiling prices for the un-enriched flour. For the new and higher levels of enrichment, the total addition to the ceiling price after October 1st is therefore 17 cents per hundredweight or 34 cents per "barrel" of 200 lbs."

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- herman, f. . and reerson, To stance ., cdern read, The Tac illan for namy, . Y. C., 1942, (389.1 Sh5'), pare 50; "According to a roort in the lancet for lurust 3, 1940, the joint co. ittee of the lister institute and the edical lesearch coincil reco. ended: 2. That there be no treatment of flour with exidizing a ents or other foreign substance which may be suspected of injuring its natritive value, 4. But the use of baking powders be discouraged because of the den or that the may increase the loss of thiamin in the baking process. Fincke and little (1941) found that the heating necessary to cook wheat-rem muffins had in itself no measurable effect upon their thiamin certent, but that this was diminished about 26 per cent when baking powder was used."

Mutrition division of the Effice of the Federal Coordinator of Health, elfare, and Telated Lefanse Activities, 20 Questions on Enriched Fread, 1941, (175.5 H54): "E. About Soda and Baking Powder? Use as usual but use soda sparingly as it tends to destroy vitamins."

- Nose, any swartz, the Foundations of Nutrition, the lactillan Company,
 N. Y. C., 1938, page 270: Topic of discussion is /itamin B (1)--"ther losses in cooking which have not been mentioned above are
 losses due to dissolving in water which is thrown away and the
 addition of soda, which increases the rate at which the vitamin
 is destroyed."
- Sherman, H. C., and Lanford, caroline S., Essentials of Attrition, 'ac'illan Company, Y. J., 1943, page 214: "In an investigation of wheat rerm muffins, it was found that there was no cocking loss of measurable degree unless soda was used, but with the use of soda there was a loss of 26 per cent of the original amount of thiarin. (or the full account, see lincke and little (1941) in the list of Sugrested Reading below, which list also gives references to other losses in cooking.)"

page 212: "Thismin, like vitamin C, is (other conditions being equal) distinctly more stable in a moderately add than in a correspondingly alkaline solution."

illians, Lobert L., and Tom L. Dies, Vitamin By and Its ise in Medicine, ac'illan Co., F. Y. C., 1938, pare 233: "In bothing powder bread a substantial fraction of the thiamin was found to be destroyed. This can be corrected by rendering the doubt acid."

outrition Reviews, The atrition condation, Inc., Chrysler Mdr., . Y. C., Jan., 1943, 3, page 88: "Acidity favored retention of thiamin and alkalinity hastened destruction. Optimin retention of thiamin may be predicated if the H does not become prester than 7.1 to 7.2 ruring the baking process."

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ranscript of iscussion on "mriched" mad held by American likers and lillers in chica o, Ill., each 5, 1941, page 9; Ir. Bailey:

"hiamin, for example, is sensitive to alkalis and is destroyed or inactivated in an alkaline medium. Therefore, it becomes increasingly is portant to control the level of acidity, relative acidity, or, as the chemist calls it, the pH, and it is deemed desirable to keep the pH in the range of what is sometimes referred to as absolute reutrality, or 7, or even slightly on the acid side of that level. Continuately, in baking yeast-leavened bread, the double and also the bread itself is commonly definitely on the acid side of neutrality."

The Journal of Autrition, Au ust 10, 1043, Vol. 26, No. 2, page 123,

"Direction of hole heat and hite Breads in the Luman Stomach",
by Rostorfer, Kochakian, and Yurlin (Univ. of Rochester): "The
recled-wheat bread baked with high-vitemin yeast undergoes gastric
proteclytic digestion 10% faster than hen the bread is baked
with ordinary baker's yeast; the free sugar formation under the
anylolytic action of seliva is 11, faster."

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BREAD, Effect of Baking Heat on Nutrients of:

Wilder, Russell M., Chief, Civilian Food Requirements Branch, F.D.A., War Food Adm., Washington, D.C., July 21, 1943: "The nutrients added in enrichment, except in the case of thiamine, are stable and not lost in baking. The loss of thiamine in baking bread is of minor importance—about 15%. Similar loss of thiamine occurs in baking whole—wheat flour. The loss in baking soda biscuits and crackers or in making toast rarely exceeds 30%—the proportion of flour used for such products is relatively small."

Food and Nutrition Board, National Research Council, Washington, D.C., May

12, 1943, Tables of Vitamin Losses in Cooking Foods:

Bread 10-15 0 10
Grain Products 0-10 0 Negligible"
Sherman, H. C., and Pearson, Constance S., Modern Bread, MacMillan Co., N.Y.C., 1942, (389.1 Sh5M), page 50: "Fincke and Little (1941) found that

Thiamine, %loss Riboflavin, %loss

the heating necessary to cook wheat-germ muffins had in itself no measurable effect upon their thiamin content but that this was diminished about 26 percent when baking powder was used."

Sherman, H. C., and Lanford, Caroline S., Essentials of Nutrition, MacMillan Company, N.Y.C., 1943, page 213: "Baking losses as reported are now known to have been above the truth in some cases, because some of the methods used for determination of thiamin do not reveal the whole amount present in the baked product. In a special study made by the Food and Drug Administration and reported in the official hearings upon the proposed new standards for bread, the baking losses ranged from too little to measure, up to about 15 percent as a maximum, and averaged less than one tenth of the thiamin originally present in the dough from which the bread was made.

"In an investigation of wheat germ muffins, it was found that there was no cooking loss of measurable degree unless soda was used,." page 212: "Like other thermolabile substances thiamin is more stable

to heating in a dry state than in solution.

Nutrition Reviews, The Nutr. Foundation, Inc., Chrysler Building, N.Y.C., Jan. 1943, 3, page 87: "Assays were conducted by Schultz and associates (Schultz, Atkin, and Frey, Cereal Chemistry 19, 532, 1942) on doughs and baked breads and the baking time varied by ten minute increments, from ten minutes (under-baked) to forty minutes (overbaked) in a rotary hearth oven at 410° F. Studies were made of the crust, the intermost crumb, and the intermediate crumb zone.

"Experimental breads consisted of enriched white bread containing added crystalline thiamine hydrochloride, enriched white bread containing high vitamin B₁ yeast, and whole-wheat bread. All these were 1 pound loaves. Thiamine assays were conducted on doughs and

finished baked breads.

"It was concluded that the stability of thiamine was not affected by its source. All sources of thiamine, during the normal bake, showed a loss of about 20 percent. Time of baking markedly influenced thiamine destruction. For example, the losses during baking for ten to forty minutes can be summarized as follows: White bread plus thiamine hydroxide, 3 to 33 percent; whole wheat bread, 2 to 33 percent, and white bread plus high vit.B₁ yeast, 6 to 32 percent. White

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(11 er, m.sell ., Chisf, Civilian Food Requirements Branch, F. A., ar Food At ., Was itn ton, 1.C., July 21, 1943: "The nurry ris saded in emichment, energy in the case of thismine, are stable on or lost in bating. The loss of thismine in bating bread is " "n r i morbance-ebout 156. Similar loss of thiamine occurs 's julied whole we are flowed the lose in beling code bisenite of carriers or in rabing 'c at warely expeads 30 -- ble proportion of flow the fer such product is relatively small."

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Therman, ". J., and landor, Caroline S., Dasentials of Virition, aclillan Corpan, ".f.f., 1043, page 213: Being losces as reported are on lower to have been alove the truth in some cases, because some of leaves don of missing to mistanting the stocker for shole ares t reseat in the baked crodut. In a special study made by the Foot and Drug Administration and reported in the official learther upon the proposed new standards for bread, the baking losses ranged from too little to measure, up to about 15 percent as a maxin w an averaged lest than one teath of the thiamin originally present in the dourk tro which the bread was made.

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BREAD, Effect of Baking Heat on Nutrients of: (continued)

bread made by commercial methods showed losses which varied from 21 to 26 percent, which is in close agreement with the losses in experimental breads baked for thirty minutes. As would be expected, the greatest losses occurred in the crust of all bread.

"In the study by Melnick and associates (Am. Baker, October (1941)) it was found that commercial nonenriched white bread contains on the average 0.35 mg. of thiamine per pound. . . . "The average loss

average 0.35 mg. of thiamine per pound. . . . "The average loss of thiamine in the tests conducted on a commercial scale was 16

percent."
"Destruction of thiamin varied from 15 to 30 percent. Thin crusty

biscuits showed greater thiamine destruction than thick biscuits. "
Nutrition Reviews, The Nutrition Foundation, Inc., Chrysler Building, N.Y.C.,
1, 1912, page 3: "In view of the fact that niacin is the most stable
vitamin known, the losses reported in cooking are surprisingly large.
From one-third to one-half is lost in steaming, frying, or roasting
and about 60 percent in baking. No explanation seems adequate to
account for these large losses and they should be accepted with
reservation until more data are available. If typical of cookery
practice, losses of this magnitude will occasion great concern and
a vast amount of recalculation of intake values."

Report of Food Research Laboratories, Inc., 114 E. 32 St., New York City, Aug. 12, 1941, page 1: "The greater destruction of thiamine in the crust was confirmed. The bottom crust of a hearth-baked bread showed more

than twice the loss of thiamine as the top crust."

page 4: "Tests were conducted to determine the partition of thiamine between crust and crumb of the bread. For this purpose a hearth-baked "pumpernickel" bread was used, since it has a particularly heavy crust both on top and bottom. The thiamine loss in the top and bottom crust are based upon the thiamine lvalue of the crumb. The bottom crust contained 34% less thiamine, the top crust 13% less thiamine than the crumb after corrections had been made, so that the comparisons could be drawn with materials of the same moisture content."

page 3: "The final tests were conducted on basal and enriched breads baked under laboratory conditions under strict supervision with analyses conducted upon the enrichment ingredients. In these tests the thiamine loss varied from 6% to 26% with the average loss being 15%. This is in agreement with the average loss noted in tests conducted with the commercially baked loaves. The stability of the vitamin occurring naturally as phosphorylated thiamine (for the most part) in enriched yeast and as synthetic free thiamine in the tablet was found to be approximately the same when used to enrich these breads."

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BREAD, Effect of Baking Heat on Nutrients of:

Report by the Food Research Laboratories, Inc., 114 E. 32 St., N.Y.C., 1941. Table JII:

"LABORATORY TESTS TO DETERMINE THIAMINE

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	LOSS DURING BAKING	
Air Dried Samples	Thiamine Content	Thiamine Destroyed by
-Su-	I. U. Per Lb.	Baking, percent
Basal bread Enriched bread	113	26
Enriched bread	465 (with yeast	21
Enriched bread		
Enriched bread	423 (mg. table	
Whole Wheat bread	656	6 "

The Journal of Nutrition, June 10, 1943, "The Contribution of Non-Fat Solids to the Nutritive Value of Wheat Breads", by Mitchell, Hamilton, and Shields (Univ. of Ill.), page 601, "The baking of bread by a commercial method leads to inconsiderable destruction of thiamine in the dough and to inappreciable destruction of riboflavin."

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BREAD, Effect of Toasting on Nutrients of:

Booher, Hartzler, Hewston, U.S.Dept. of Agr., Circular 638, May 1942,

A Compilation of the Vitamin Values of Foods in Relation to

Processing and Other Varients, (1 Ag84C), page 32:

microgr grams o	(vitamin B ₁) cams per 100 of edible portion
Wheat bread*, made with high-vitamin-B ₁ yeast; New York; fermentation method: Before toasting	1,080 1,020 970
Before toasting	1,70 1,20 370
Before toasting	750
Wheat bread, white, New York, fermentation method: Before toasting	100 120 120 110 100 100 100
Before toasting	100
Wheat bread, white, made with high-vitamin-B ₁ yeast; New York; fermentation method: Crust of toasted slice	690 870 1,080
Entire toasted slice	1,020 "

^{*} This is probably white bread

EREAD, Effoct of feasting on Mutrieuts of:

Mosher, Martalar, Howaton, V.S. Rept. of igr., Circular 658, May 1942, A Cornilation of the Vitarin Velusa of Foods in Relation to Proversion and Vil " Lariente, 1 Ag 16), 198 52:

Thismip (vite. in B ₁) microgrems for 100 where of adible port	
	West breed *, made with high-witenin-3; yeast; "ev ord; fermentation ethod:
1,080	Tefore toarbed
. 140 061	· · · · · · · · · · · · · · · · · · ·
	Fearily brasted
	Before transfers
	Reat bread, white, New ork, fermentation method:
100	Before toasting
	Possible slice Cember morblem of togsted slice
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001 .	Pefore toering
Ig	Most broad, white, mede with high-witamin-
690	Grust of toseted citee
1,080 '	Tenter portion of toacted slice

^{*} This is rereably white bread

BREAD, Effect of Toasting on Nutrients of:

Booher, Hartzler, and Hewston, (continuation of page 1.)

Thiamin (vitamin B₁) micrograms per 100 grams of edible portion

"Wheat	bread,	whole,	New	York,	fermentation
nethod	:				
D - 0	1	andre de la compa			

Before toasting	670 650 590 530 670
Center portion of toasted slice	750 680 "

Wilder, Russell M., Chief, Civilian Food Requirements Branch, F.D.A., War Food Adm., Washington, D.C., July 21, 1943: Concerning the destruction of thiamin: "The loss in baking scda biscuits and crackers or in making toast rarely exceeds 30 percent."

How to Use Bread in Modern Baking, Zinsmaster Baking Company, 1942, (our files C-221), page 23: "Effect of Toasting Bread on Vitamin Content: It is recommended that bread be toasted lightly or not at all as thiamin is readily destroyed by dry heat. For variety's sake toast is used occasionally in menus. Thin toast loses more thiamin than thick toast. Welba toast loses most of all. This should be noted when including them in the dietary."

Nutrition Reviews, The Nutrition Foundations, Inc., Chrysler Bldg., N.Y.C., Jan 1943, 3, page 88: "(Melnick, Mabardie, Bernstein, and Oser, American Baker, Oct. 1941) Toasting of bread led to an additional loss of thiamine ranging from 11 to 25 percent depending upon the degree of toasting. Toast as usually prepared contained about 15 percent less thiamine than the original bread."

Report, Food Research Laboratories, Inc., 114 E. 32 St., N.Y.C., 1941, pagel: "Toasting of bread results in an additional loss of thiamin of 11 to 25 percent, this extent of such loss ranging with the degree of toasting. Toast as usually prepared contains about 15% less thiamine than the original slice of bread."

page 4: "The best index of the degree of toasting in the determination of the total solids, since moisture is the primary bulk which is lost and the extent of such loss varies with the degree of toasting. When the thiamine content is calculated in terms of the same total solid content per slice, a direct proportion is found between the degree of toasting and thiamine destroyed. Light toast contains 11% less thiamine than the original bread, toast as usually prepared contained 15% less thiamine and fully 25% was lost in preparing heavy toast."

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BREAD, Effect of Toasting on Nutrients of:

Cereal Chemistry, May, 1943, Volume XX, No.3, Lancaster, Pa., page 352, "Thiamin Losses in Toasting Bread", by Downs and Meckel: "Surveys show that much bread is consumed as toast. In some areas this is said to exceed 35% of the total consumption."

. . . The following table was among reports read at the annual meeting of the American Institute of Baking, Chicago, Ill, May 1942:

Thiamin and Moisture in Bread and Toast (All data converted to 38.0% moisture basis)

	Coasted Seconds)	Moisture %	Moisture loss %	Thiamine microgr. per gm.	Thiamin loss %	Thiamin in 6 slices toast
Unenriche White Br		38.0 32.7 31.3 29.2 24.3 23.0	0.0 14.0 17.6 23.1 36.0 39.5	0.86 0.78 0.67 0.69 0.63 0.59	0.0 9.2 22.1 19.7 26.7 31.4	0.138 0.126 0.108 0.110 0.102 0.096
Enriched White Bread	0 30 40 50 60 70	38.0 34.6 30.9 29.9 28.4 26.2	0.0 9.0 18.6 21.4 25.3 31.0	2.76 2.62 2.57 2.40 2.35 2.29	0.0 5.2 7.0 13.0 15.0	0 • 496 0 • 454 0 • 444 0 • 4406 0 • 396
100% Whole Wheat	0 30 40 50 60 70	38.0 32.1 30.0 29.9 25.6 24.5	0.0 15.6 21.0 21.3 32.6 35.5	3.36 3.22 3.08 2.94 2.85 2.65	0.0 4.0 8.2 12.5 15.3 21.0	0.532 0.506 0.486 0.462 0.450 0.418

[&]quot;Ten persons were asked to view the toast samples and express their preference as to degree of tasting. Eight preferred samples toasted 50 seconds; one preferred 40 seconds; and the tenth said he liked his toast between the 40 and the 50 second sample."

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creal limistry, ". T. P. Volume ... 19.5, lence ter, Pa., page 352, lence ter, Pa., page 352, lence term of both to unvert the term that much traid is construct as mest. In some areas this is extend to exceed 35% of the total consumming.

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Thiamin in S slices to st	min of Maria	Thismine wiorom.	erusator Pass	970 Faio	.edaso'. (% 2003)
0.126 0.126 0.110 0.102 0.102	C.O C.S.2 C.S.2 F.S.2 F.S.2 F.S.2	88.0 78.0 78.0 78.0 78.0	0.0 27.6 27.6 29.1 39.5	5.8 52.7 51.5 51.5 51.5	o beintro al CE vel sach Cui Oi Oi Oi
0.596 0.444 0.444 0.444 0.446	0.0 7.0 7.0 25.0 15.0	2.76 2.60 2.57 2.40 2.35 2.25	0.0 0.0 0.8 0.18 0.18	0.88 3.48 9.08 9.03 4.03	Barsonco 7 30 30 30 30 30 30 30 30 30 30 30 30 30
0.532 0.566 0.462 0.450 0.416	0.0 2.5 3.2.5 2.21 2.31	3.36 3.37 3.0.5 20.5 20.5 30.9	6. F. S.	0.25 0.05 1.8 1.8	11.0% (1.0%) (1.

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BREAD, Use of Milk in:

Nutrition Reviews, Nutrition Foundation, Inc., Chrysler Gldg., N.Y.C., Jan. 1943, 5 page 88: "Biscuits made with milk seemed to show somewhat greater thiamine retention than water biscuits." (Cereal Chem., 19, 121 (1942)).

Sherman, H. C., and Constance S. Pearson, Modern Bread, MacMillan Co., 1942 page 27: "Thus the proteins of white flour arelatively poor in lysine and tryptophane, while the proteins of milk, eggs, and meat

are relatively rich in both these amino acids.

"In an extended series of researches by Osborne and Mendel (1919), it was found that, while the proteins of white flour - even when fed at liberal percentages of the food mixture - supported little if any growth, good growth was obtained when either milk, eggs, or meat protein constituted one-third, and white-flour protein two-thirds, of

the total food protein.

"Our own exploratory research experiments tend to indicate also that, when dried skim milk is used in breadmaking in the proportion of six pounds to each hundred pounds of white flour, the proteins of the latter are so supplemented that the resulting white bread is adequate in meeting the protein requirement of growth. Such bread, however, is not equally adequate as a source of some of the mineral elements and vitamins."

page 37: "On the other hand, the addition of milk (chiefly as skim milk solids) in breadmaking, which significantly enriches the bread in calcium as well as in protein, riboflavin, and some other nutritional factors, has increased markedly in the United States during the past ten or twelve years. It is now reported that most of the baker's bread made in this country, other than that of the so-called French and Italian types, contains skim-milk powder to the extent of about six pounds for each one hundred pounds of flour used. Such an addition of milk solids would rather more than double the calcium content which ordinary white bread would otherwise have." page 79: "This exploratory research, considered in comparison with earlier experiments in this laboratory in whichwater bread was used, may be taken to indicate an objectively demonstrable nutritional superiority in the bread made with 6 percent as much skim-milk powder as white flour, but may not be taken radically to change the position of bread as a food."

Nutrition Reviews, Nutrition Foundation, Inc., Chrysler Building, N.Y.C.,
August 1943, page 297: "Not all the flour in the American diet is
consumed in the form of bread and not all bread is made with 6 per
cent dried skim milk. Indeed, the amount of dried skim milk available
is insufficient at the present moment to permit the enrichment of all
white pan bakers' bread to this extent. The first order of the
Food Administrator required that all white bakers' bread, beginning
Jan. 1943, should be enriched with and not less
than 3 percent nor more than 4 percent (based on the weight of the
flour as 100 percent) of dried skim milk. It has been recommended
by the Food and Nutrition Board that when supplies become available,
the amount of dried skim milk in white pan bread be increased to
the 6 percent level."

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Tetr ter newters, "utritten toundestion, LL., Unry ler Gldg., ".1.C., Int. 1913, 5 page 10: "Disertes melo with mill scened to show so sowher meeter thirmine retention than weter bisouits." (Gereal Com., 1:, 101 (112)).

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are relatively rich is to these amino weigs.

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pare 37. On the citer hand, the subtion of milk (chiefly as skind if subide, in breadraking, which significantly unriches the bread in relicious actions and some other nutricional factors, has increased in the file United States during the rast ten or twelve years. It is now no inted that most of the fact 's bread had in this containt than that of the so-calle years and Italian types, contains kir-milk powder to the extent of other and relicious of the extent of other and six permis for each ore hundred, exude of flour used. Such a subition of milk relices rould rather more than double the nation of outer the char couble the nation of outer of the break relicions which other have have."

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BREAD, Use of Milk in:

The Journal of Nutrition, June 10, 1943, "The Contribution of Non-Fat-Nilk Solids to the Nutritive Value of Wheat Breads", by Mitchell, Hamilton, and Shields (Univ. of Ill.), page 601: "Enriched white bread containing 6% of dried skim milk is definitely superior in growth-promoting value and in hemoglobin production to enriched white bread supplemented to an equivalent extent with dicalcium phosphate and riboflavin; however, the former is definitely, if only slightly, inferior to the latter in bone calcifying value." - 3

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BREAD, Shortening In:

Nutritition Reviews, the Nutrition Foundation Inc., Chrysler Bldg., N.Y.C.,
August, 1943, page 207: "The first order of the Food Administration required that all white bakers' bread, beginning January
1943, should be enriched with thiamine, niacin, and iron, and
also that it contain not more than 2 percent of shortening, and
not less than 3 percent nore more than 4 percent of dried skim
milk."

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PREAD, GOVERNMENT REGULATION OF:

Federal Pegister, Aug. 3, 1943; page 10786

Food and Drug Adm., Farm Security Agency: Various Kinds of Breads, definition and standards of identity. Regulations:

- Sect. 17.5: Bread and rolls or buns; identity; label statement of optional ingredients. (a) Should be made of flour, liquid, salt, and it may contain one or more of the twelve following ingredients: shortening; milk; buttermilk; eggs; sugar; malt; vegetable flour; ground soybeans; calcium or ammonium phosphates or sulphates; bromates, icdates, or peroxides; monocalcium phosphate, vinegar, and
- and calcium or sodium propionate (if either the former of the latter is used the label must read -- "added to retard spoilage"); and spice (in this case the label must read "spiced" or "spice added" etc.)
 - (b) Loaves must weigh one-half pound or more after baking, and rolls and buns are made into units each of which weighs less than one-half pound after baking.
- Sect. 17.6: Enriched bread and enriched rolls or enriched buns; identity; label statement of optional ingredients. It shall conform to definition and standard of identity and be subject to label statement for optional ingredients of bread in section 17.5, except that it contain in each pound not more nor less than the prescribed amounts of the following ingredients; thiamin, riboflavin, niacin, iron. It may also contain Vitamin D, calcium, and wheat germ. Enriched flour may be used in whole or in part instead of flour The prescribed amounts of required or optional ingredients may be added by means of enriched flour, or through direct addition of such substances, or through the use of any ingredient containing such substance (high vitamin B yeast).
- Sect. 17.7: Milk Bread and milk rolls or buns--bread made as prescribed in Sect. 17.5 except that milk is added.
- Sect. 17.8: Raisin Bread and raisin rolls or raisin buns bread made as prescribed in Sect. 17.5 except that raisins are added.
- Sect. 17.9: Whole wheat bread, graham bread, entire wheat bread, and whole wheat rolls, graham rolls, entire wheat rolls, or whole wheat buns, graham buns, entire wheat buns made as prescribed in Sect. 17.5 except that the dough is made with whole wheat flour and no flour is used therein.
- Sect. 17.10: Breads and rolls or buns made with mixtures of flour, whole wheat flour, cracked wheat, crushed wheat made as prescribed in Sect. 17.5 except that the dough is made of a mixture of two or more of the following wheat ingredients: flour, whole wheat flour, cracked wheat and crushed wheat. The bread, rolls or buns made from such mixtures is named according to the ingredient in predominance. Graham, whole wheat, and entire wheat are names of synonymous usage.

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EFFECT OF DRYING ON NUTRIENTS OF FLOUR AND BREAD:

Rose, Mary Swartz, The Foundations of Nutrition, MacMillan Co., 1938, page 272: Discussion of vitamin B1: "Drying does not seem to affect this vitamin unfavorably."

Booher, Hartzler, and Hewston, U.S. Dept. of Agr., Circular 638, May 1942,

A Compilation of the Vitamin Values of Foods in Relation to

Processing and Other Varients, (1 Ag840), page 32:

Bread, wheat, made with commercially enriched flour, Thiamin bakery sample, 1/2 inch thick, and slices removed; Vitamin B₁

Washington, D.C.; rat growth method:

Micrograms

Per 100 gms of

Fresh whole slices, average for six loaves. 240
Pried whole slices, average for six loaves, 370

33.6 percent moisture.
Fresh crust, 1/4 inch thick, composited 220

from 1/2 loaves, 23.6% moisture.

Pried crust, 1/4-inch thick, composited 290 from 1/4 loaves.

Fresh, inner portion of slices, 1/4-inch 240 crust removed, 39.4% moisture

Dried, inner portion of slices, 1/4-inch 400 crust removed.

Sherman, H. C., and Caroline S. Lanford, Essentials of Nutrition, MacMillan Company, New York, 1943, page 212: "Mature dry, unbroken seeds seem to contain their thiamin in a relatively stable form and favorable environment. In one published report, the evidence of local records was accepted as showing that wheat taken from the bottom of a certain tight dry granary compartment was a century old. On feeding to experimentals animals it was found to be a potent source of thiamin."

Williams, Ribert R., and Tom D. Spies, Vitamin B₁ and its Use in Wedicine, MacMillan Company, N.Y.C., 1938, (1448 W672), page 232: "In yeast breads there appears to be fairly general agreement that the thiamin content on an air dry basis corresponds very closely to that of the flours used. The yeast which is used in proportions of 1 part to 100 of flour or less does not add significantly to the thiamin content. Copping and Roscoe's results by the rat growth method are typical:

	Air Dried	Fresh	
White, sponge	1.0	0.68 (
White, short dough	1.48	1.0 (
White, long dough	1.48	1.0 (from 72% flours. "
Whole meal	4.72	3.0 (,

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EFFECT OF DRYING ON NUTRIENTS OF FLOUR AND BREAD

Nutrition Revisws, the Nutrition Foundation, Inc., Chrysler Bldg.,
N.Y.C., Vol. 1, No. 9, July, 1943, page 288: "Thiamin
Stability in Wheat Germ": "Students of nutrition will be
interested in his observation that the thiamin content, as
determined by the thiochrome method, did not vary even though
the wheat germ might become rancid. Thus in one series of
experiments, the thiamine content was initially 14.2 micograms
to the gram, and after two weeks 15.5 micograms to the grams,
where the value remained constant for 36 weeks."

Science, The Science Press, Lancaster, Pa., July 3, 1942, page 22,
"Destruction of Riboflavin by Light.": "It seemed noteworthy
that large losses, up to 48 percent, occurred in instances in
which cooking was done in open vessels so that the food was exposed
to light during cooking.

Light Destruction of Riboflavin in Solution

	THE PARTY NAMED IN	-010101	
Time of exposure, minutes		Percent des	
(Temperature100°C.)	pH 3	рн 4.5	pH 6.5
5	3.6	28	42
15	1,2	62	72
30	60	84	91
45		90	99
60	95	97	99
90	フン	71	77
Time of exposure, 1 hr.		Percent des	truction
, , , , , , , , , , , , , , , , , , , ,		Tempera	
	320	750	1000
рН 3	200	12	95
	96	6.6	
pH 4.5	16	66	97
pH 6.5	51	99	99
Dark, 100° for 1 hour		Percent destr	uetion
рн 4.5		1	
pH 6.5		0	

It is apparent from Table 1 that increases wither in alkalinity or temperature accelerate the destruction of riboflavin, at quite a rapid rate. Temperature and pH affect the light reaction rather than other chemical destruction, for when riboflavin solutions are heated in the dark no destruction occurs.

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MOISTURE CONTENT OF FLOUR AND BREAD:

Report, Food Research Laboratories, 11/4 East Thirty-Second St., N.Y.C., 1941, page 1, second part: from table concerning the analyses of commercial breads -- "The basic assumption in these tests is that 150 pounds of bread (35% moisture content) are derived from 100 pounds of flour."

page 4: "The best index of degree of teasting is the determination of the total solids, since moisture is the primary bulk which is lost and the extent of such loss varies with the degree of toast-

ing."

Federal Register, Washington, D. C., May 27, 1941, page 2578, (Enactment by the Food Food and Drug Administration): "The flour is freed from bran coat, or bran coat and germ, to such extent that the percent of ash therein, calculated to a moisture-free basis is not more than the sum of one-twentieth of the percent of protein therein, calculated to a moisture-free basis, and 0.35. Its moisture content is not more than 15 percent."

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The look paint ton, W. Tay 27, 1941, page 2578, (Erackrent be the look look and brug Administration): "The flowr is freed from head cont, a bran crat and germ, to such extent that the percent of set the relay calculated to a moisture-free basis is not more from the such of our-twentieth of the percent of protein therein, all aleted to a moi twe-free basis, and 0.55. Its moisture continuous took than 15 percent.

*RYE Bread and Flour:

Transcript of Discussion on "Enriched" Bread and Flour held at the National Conference of American Bakers and Millers in Chicago, Ill., March 5, 1941; page 3 of Regular Conference Report; Dr. Bailey: "Well, we'll talk about the rye grain, I guess. There are no great number of data available to me at the moment respecting the actual vitamin content of rye. Such as have been published indicate that insofar as the thiamine or B, is concerned, the level in whole rye is approximately that of wheat. However, in the instance of rye flour, I can only conjure at the moment, not having with me any precise date representing the vitamin content of the flour itself, but I fell that it is a reasonable assumption that the thiamine content, at least, of rye flour will be in the same general range as that of wheat flour of the same ash or mineral content. That is an assumption and further work will need to be done before we will know as much as we need to know about the levels in the rye flour itself."

page 10; Dr. William A. Quilan, General Counsel of the American Bakers Association: "However, I see no reason why the nutrition-ists, within their discretion, might not recommend that there be such a product as enriched rye bread. I believe there was some concern on that this afternoon and I attempted to get hold of Dr. Wilder or any of the other representatives of the National Research Council, but in that respect, as to the possibility of enlarging the recommendations to include such a product as rye bread, I think we might well hold that open for the time being, Mr. Chairman, and attempt to get some further information that might serve as a guide."

page 2; Dr. W. H. Sebrell, U.S. Public Health Official: "It is my personal opinion that an enriched rye bread should not be made and sold under the present conditions."

^{*}Although rys may be mentioned elsewhere, the major part of the compilation on Cereals concerns wheat.

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CORNMEAL AND CORNBREAD:

Transcript of Discussion of "Enriched" Bread and Flour, held by the American Bakers and Millers at their National Conference in Chicago, Ill, March 5, 1941; Consumers Division, page 6; Miss Gladys E. Hall, Educational Director of the American Dietetic Association: "Another question might be grought up here, although perhaps it isn't the first concern of this group, and that is whether or not cornmeal would be a products that should be or might permissibly be enriched. Perhaps it comes in the class of soya been flour, which was brought up this afternoon. I don't know the answer to that but I am wondering." Dr. Helen Mitchell, Nutr. Consultant to the Coordinator on Health Problems: "The question has been brought to me several times as to whether cereals of various types, including cornmeal or wheat cereals, were going to be enriched and whether standards will be set up for them, and I have answered that as yet no such idea is in mind and no standards have been set; that whole grain breakfast cereals are still just as good as they always have been and that there is no reason to set up any special standards. But the cornmeal that is on the market, as I understand it, does not contain the germ and bran, except that cornmeal which is ground in the small local mills in the South.

"The nicotinic acid question in the South, of course, is one which has been brought up in the previous round table and corn, even when whole, as I understand it, does not contain as much as wheat. Therefore, the deficiency of nicotinic acid is accentuated in that part of the country where corn is consumed in larger quantities than is wheat."

*Although cornmeal and cornbread may be mentioned elsewhere, the major part of this compilation on Cereals concerns wheat.

JR. TAL AT CORTERLAD:

ra of pt of iscussion of "Lurioh d" Bread and Flour, hold by the I mer 'can Pa'ers and Villers at their Mational Conference in Oldero, Ill, Orch 5, 1941; Consumers Division, pare of iss Aladra 2. Dall, Reveational Director of the American Dietatic eriess it isn't the first concern of this group, and that is wo of bivode tadt adoubtra a ed Siver Leaunnee that or redtoiw might for issibly be suriched. Ferlaps it comes in the class of soys been flour, which was brought up this afternoon. I don't know the caswer to them but I am wondering." Ir. Welen thokel Tutr. Consultant to the Coordinator or Mealth Froblems: "The question has been brought to me several times as to whether enreals of vertous types, including corners or wheat corecle, au jes of Ifiw abreinsts redjew one help inte of of anjo enew the trees, and I have answered that as yet no such idea is in raind ord no standards have been set; thet whole grain breakfiast orread are still just as good as they always have been and that there is mo respon to set up any smodal standards. But the cornneal that is on the merket, or I underseard it, does not contain the germ s I bran, errort that corposal which is ground in the small local

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CORNMEAL AND CORNBREAD:

The Enrichment of Cornmeal and Grits, E. J. Lease, South Carolina Agricultural Experiment Station, Clemson, South Carolina, May 1943, Circular 64: "Summary 1. Grits and degerminated corn meal are like white and patent flour in that they have undergone a refining process whereby most of the vitamins and minerals have been milled away. 2. Much emphasis has been placed upon the enrichment of white flour but until recently very little attention has been given to the enrichment of corn meal and grits. 3. At the request of the State Nutrition Committee and several other organizations the South Carolina General Assembly enacted a law which required the enrichment of grits and degerminated corn meal sold in South Carolina. 4. The enrichment of corn meal of all types is usually accomplished by the same mixing process as is used in enriching white flour. 5. Since grits are washed before cooking, it is necessary to use a special granular premix to enrich them. The enriching ingredients are not lost from this premix in washing because they are enveloped in gelatinized starchy particles. 6. The enrichment of corn meal and grits does not change their appearance, cooking properties, or taste, but does add materially to their nutritional value. 7. The total cost of enrichment is about 15 cents per 100 pounds of grits, about 10 cents per 100 pounds of degerminated corn meal, and 5 cents or less per 100 pounds of whole-corn meal.

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rich i of ferm alan) frits, L. C. Tears, louth Carolina richteral sport out tathon, her or, South Carolina, y 1967, birothur (c. "Summary L. mits est teraralmated ered gold to to all golf oreder bee edition off ere from one uniconcer a religio recees ricrety mest of the itemina and rigerals less been sill famon. 2. Tueb or den's been mid record it is a firm of the children to the mark to the continue of warm little weight of an been siven to the craft thront of corn modding to the form of the start and the same than the יו בין פי נין פסי אופן חידים די תרונים נוחשו לדים יסודי לנייווות faction Assembly entere so intrological country of the entichment of that I'm in the Complete with the including the Benth Police. is the carteliners of comment of and transferencedly row mrlished by the east militar coucees as is seed in confiding white Minum. T. Singa milds are weened before anothe in rii and during of river includer late to oper to respond and the form is a few and the color of the same at the color of the color of .asto drag mier to hoofmidelen at hepotern are yet no seed t. The enviolement of come whal siz file for with cheaps their eoperments, coching momenties, or met., but coce and metaria to their sutsition in walks. To ratal cost of emident : book li cents en in por de of thee, acout 10 cents per 100 rounds of herex did on our road, and 5 norths on less ner 100 mount of we off - or un oat.

BUCKWHEAT:

War Emergency Bulletin, Cornell Bulletin for Homemakers, March 1943,
Bulletin 576, "Bread and Whole-Grain Cereals", page 2: "Cornmeal,
rye and buckwheat are classed also as whole-grain products.
Although they are not so nutritious as are soybeans, whole wheat,
or cats, they contain more food value than do more refined products,
and their occasional use adds variety to the menu.

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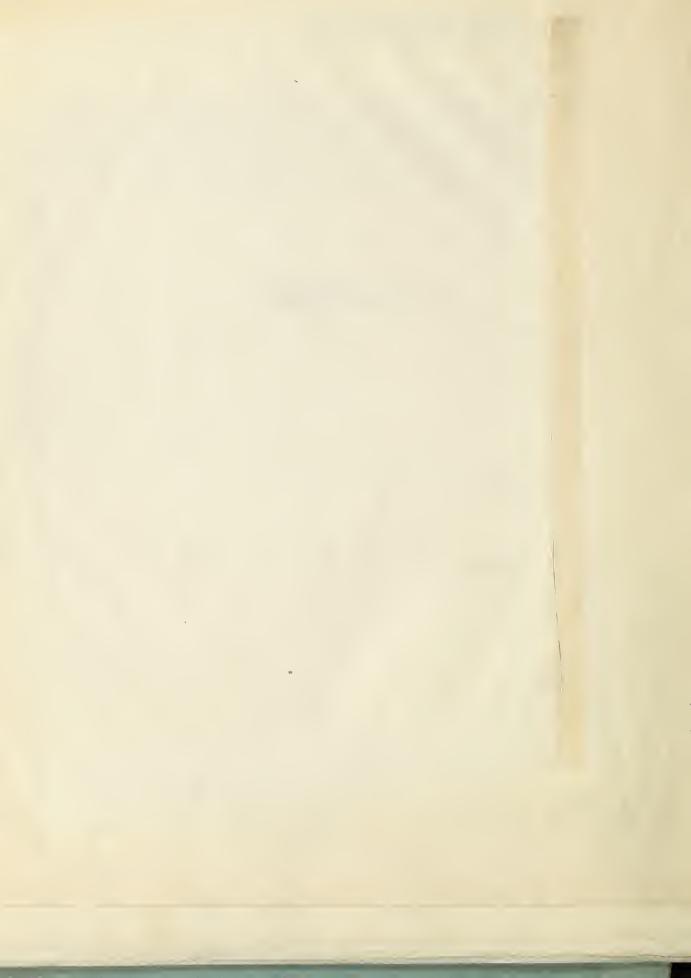
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APPENDICES

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Millers at the National Federation, Chicago, March 5, 1941
Zionmaster Baking Company, "How to Use Bread in Modern Meals", 1942

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COMPARISON OF NUTRIENTS IN ENRICHED FLOUR AND BREAD SPECIFIED BY LEGISLATION OF 1941 WITH NUTRIENTS SPECIFIED BY AMENDMENT OF 1943

	THIAM	IN	
	1941	1943	
Amount in 1 lb. flour (a)	1.66 mg - 2.5 mg	2. mg - 2.5	TO CO
Amount in 1 lb. bread (b)	1. mg - 4. mg	0	mR.
Amount in 1 slice (1 oz.) bread	0.06 mg - 0.25 mg	1.1 mg - 1.8	
	9	0.07 mg - 0.11	mg
Amount in 6 slices (6 ozs.) bread	0.38 mg - 1.5 mg	0.41 mg - 0.67	mg
N.R.C., Recommended Daily Allowances, Man (70 Kg.) Mod. Active3000	cal. (d) 1.8 m	_	
		~	
Percent Recommended Daily Allowance contributed by 1 lb. flour	92% - 139% -	111% - 139%	
Percent Recommended Daily Allowance contributed by 1 lb. bread	56% - 222% -	61% - 100%	
Percent Recommended Daily Allowance contributed by 1 slice bread	3% - 14% -	4% - 6%	
Percent Recommended Daily Allowance contributed by 6 slices bread	21% - 83% -	23% - 37%	
Food and Drug Administration, Minimum Daily Requirements, Adult (e)	1 mg		
Percent Minimum Daily Requirement contributed by 1 lb. flour	166% - 250%	200% - 250%	
Percent Minimum Daily Requirement contributed by 1 lb. bread	100% - 400%	110% - 180%	
Percent Minimum Daily Requirement contributed by 1 slice bread	6% - 25%	7% - 11%	
Percent Minimum Daily Requirement contributed by 6 slices bread	38% - 150%	41% - 67%	
2420000 management 2400000 4000000 4000000 mg	200/0	/0	
	CALCI	UM	
	1941	1943	
Amount in 1 lb. flour (a)			625 mg
	—	0	800 mg
Amount in 1 lb. bread (b)	9	9	
Amount in 1 slice (1 oz.) bread	20.81 mg - 83.31	mg 18.75 mg -	50 mg
	9	mg 18.75 mg -	50 mg
Amount in 1 slice (1 oz.) bread Amount in 6 slices (6 ozs.) bread	20.81 mg - 83.31 124.86 mg - 499.86	mg 18.75 mg - mg 112.5 mg -	50 mg
Amount in 1 slice (1 oz.) bread Amount in 6 slices (6 ozs.) bread N.R.C., Recommended Daily Allowances, Man (70 Kg.) Mod. Active3000	20.81 mg - 83.31 124.86 mg - 499.86) cal. (d)8	mg 18.75 mg - mg 112.5 mg -	50 mg 300 mg
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Amount in 1 slice (1 oz.) bread Amount in 6 slices (6 ozs.) bread N.R.C., Recommended Daily Allowances, Man (70 Kg.) Mod. Active3000 Percent Recommended Daily Allowance contributed by 1 lb. flour Percent Recommended Daily Allowance contributed by 1 lb. bread Percent Recommended Daily Allowance contributed by 1 slice bread	20.81 mg - 83.31 124.86 mg - 499.86 cal. (d)8 63% - 250% 42% - 167% 3% - 10%	mg 18.75 mg - mg 112.5 mg - 00 mg 63% - 38% - 2% -	50 mg 300 mg 78% 100% 6%
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⁽a) Flour Standards: Federal Register, May 27, 1941, page 2580; Federal Register, July 3, 1943, page 9116
(b) Bread Standards: Federal Register, June 7, 1941, page 2772; Federal Register, Aug. 3, 1943, page 10787
(c) Postponement of Required Riborlavin: Fed. Register, Dec. 3, 1941, pol76; Fed. Register, March 19, 1943, p3358

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	NIACIN	1941		1943		,	ostponed)	1943 (Red	mi red)
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		- 15. mg 4.	mg - 16 mg		ng - 12.5 mg	0.8 mg	- 3.2 mg	0.7 mg -	
24	1 mg 0.63 mg		•		ng - 0.78 mg	0.05 mg	- 0.2 mg		
0.25 mg -	6 mg 3.75 mg		mg - 6 mg		ng - 4.68 mg		- 1.2 mg		
1.9 шЕ -	O mg			3			0		
	- 18 mg		1	2 mg	D 400 400 100		2.7 mg		
	33% 89% -	111% 50% -	200%	108% -	137%	44% -	67%	44% -	56%
/-	89% 56% -	83% 33% •	- 133%	66% -	104% -	30% -	119%	26% -	59%
	6% 4% -	5% 2% .	8%	4% -	7%	2% -	7%	1% -	4%
8% -	33% 21% -	31% 13% .	50%	25% -	39%	11% -	44%	10% -	22%
	- 10 mg (f)			0 mg			2 mg -		
	40% 160% -	200% 60% -		130% -	165%	60% -	90%	60% -	75%
	.60% 100% -	150% 40% •		80% -	125%	40% -	160%	35% -	80%
	10% 6% -	9% 3% .		5% -	8%	3% -	10%	2% -	5%
15% -	60% 38% -	56% 15% •	- 60%	30% -	47%	15% -	60%	13% -	30%
	0 7 0 7 0 27	* A 1" 57 27 00 Ps 7° 1°s	75 th C						
	OPTION VITAMIND	AL NUTRIE	N T 5			AD COUNTY			
1941	1943		1941	and 1943	WELL	AT GERM			
250 USP - 10		USP - 1000. USP			for: Federal	Baristons	10/11 and 10.	12 (0) 114	de mare
160 USP - 6		USP - 750. USP			not more than 5				
	40 USP 9.38				fatted wheat ge		wergine or w	man Sarm	71
60 USP - 2		USP - 281.25 USP		parory ac	racced mileac 80	A LIL 9			
		002 -02440 (103		Standards	for: Federal	Registers.	1941 and 19	43 (b). "	ach
	- 400 USP (g) -		274 0000		l may also conta				
	50% 63% -				partly defatted				
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15% -	60% 14% -	70%		•				_	
					•				
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4	60% 38% -	/-							
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⁽d) Recommended Daily Allowances: National Research Council's Circular, Number 115, January 1943, page 2 (f) & (g) N.R.C.: Niacin-10 mg Req. tentatively set; Vit. D-400 (USP) allowance assumed, Circ. 115, 1943, p3,f'n.

*COMPARISON OF	VARIOUS BREADS	WHITE	wor mp		
1	y, FDA, Nov. 1943	(a)(h)	WHITE ENRICHED	WHITE WITH MILK-3.7%	WHITE RAISIN
1,010 1,010 1,01	, FDA, NOV. 1940		(d)	(c)(h)	(a)(h)
Calories	(1 pound	1184	1184	1185	1325
Garonies	**(1 ounce (6 ounces	74 444	74 444	74 444	83 497
Duchala	(1 pound	41.73 gm	41.73 gm	38.60 gm	29.93 gm
Protein	**(1 ounce (6 ounces	2.61 gm 15.65 gm	2.61 gm 15.65 gm	2.41 gm 14.48 gm	1.87 gm 11.22 gm
	(1 pound	5.90 gm	5.90 gm	9.10 gm	30.84 gm
Fat	**(1 ounce	0.37 gm	0.37 gm	0.57 gm	1.93 gm
	(6 ounces	2.21 gm	2.21 gm	3.41 gm	11.57 gm
Combala a la cala de la	(1 pound	240.86 gm	240.86 gm	237.20 gm	231.79 gm
Carbohydrate	**(1 ounce	15.05 gm	15.05 gm	14.83 gm	14.49 gm
	(6 ounces	90.32 gm	90.32 gm	88.95 gm	86.92 gm
Calcium	(1 pound	0.23 gm	****0.30 gm	0.32 gm	0.24 gm
Carcium	**(1 ounce	0.01 gm	****0.02 gm	0.02 gm	0.02 gm
	(6 ounces	0.09 gm	****O.11 gm	0.12 gm	0.09 gm
Dhamb	(1 pound	0.44 gm	0.44 gm	0.44 gm	0.40 gm
Phosphorus	**(1 ounce	0.03 gm	0.03 gm	0.03 gm	0.03 gm
	(6 ounces	0.17 gm	0.17 gm	0.17 gm	0.15 gm
***Iron	(1 pound	3.63 mg	8.00 mg	3.86 mg	3.63 mg
+++T1 OH	**(1 ounce	0.23 mg	0.50 mg	0.24 mg	0.23 mg
	(6 ounces	1.36 mg	3.00 mg	1.45 mg	1.36 mg
***Thiamin	(1 poung	0.25 mg	1.10 mg	0.27 mg	0.36 mg
***IIITOMITH	(6 ounces	0.02 mg	0.41 mg	0.02 mg	O.OE mg
					0.14 mg
www.Diba@lawin	(1 pound	0.18 mg	0.30 mg	0.47 mg	0.20 mg
***Riboflavin	**(1 ounce (6 ounces	0.01 mg 0.07 mg	0.04 mg 0.26 mg	0.03 mg	0.01 mg
		0.01 mg		0.18 mg	0.08 mg
of the stability of the	(1 pound		10.00 mg	3.00 mg	
***Niacin	**(1 ounce		0.63 mg	0.19 mg	-
			3.75 mg	1.13 mg	
and the same	(1 pound		****150.00 USP		3.1
Vitamin D	**(1 ounce		* 9.38 USP **** 56.25 USP		9.8
	(6 ounces		**** 00.20 USP		
	(1 pound				and a
Vitamin A	**(1 ounce				
	(6 ounces				3 4

^{*}Blank spaces indicate that information was not given in the respective source.

**Approximate Equivalents: 1 pound equals a 16-slice loaf of bread, 24 biscuit, 8 slices of Boston brown bread, 4 pones of corn bread, or 40 crackers; 1 ounce equals 1 slice of bread, 1½ biscuit, ½ slice of Boston brown bread, ¼ pone of corn bread, or 2½ crackers; 6 ounces equal 6 slices of bread, 9 biscuit, 3 slices of Boston brown bread, 1½ pone of corn bread, or 15 crackers.

***A range of figures was given in some instances, but only the minimums are recorded.

****Optional Ingredients.

⁽a) Sherman, Henry C., Essentials of Nutrition, MacMillan, New York, 1943, pages 370-384. In the calculation of pound values, tables were multiplied by factor 4.536.

WHOLE WHEAT (a)	WHOLE WHEAT-50% (*e)(h)	WHOLE WHEAT WITH Milk-3.7% (c)	WHOLE WHEAT RAISIN (a)	RYE (a)	RYE WITH MILK-3.7% (c)
1111	1188	1184	1220	1152	1145
69	74	74	76	72	72
417	446	444	458	432	429
43.99 gm	38.96 gm	40.80 gm	33.11 gm	40.82 gm	40.40 gm
2.75 gm	2.44 gm	2.55 gm	2.07 gm	2.55 gm	2.53 gm
16.49 gm	14.61 gm	15.30 gm	12.42 gm	15.31 gm	15.15 gm
4.08 gm	4.99 gm	13.60 gm	14.06 gm	2.72 gm	9.10 gm
0.26 gm	0.31 gm	0.85 gm	0.88 gm	0.17 gm	0.57 gm
1.53 gm	1.87 gm	5.10 gm	5.27 gm	1.02 gm	3.41 gm
225.43 gm	233.15 gm	224.10 gm	241.32 gm	241.32 gm	225.40 gm
14.09 gm	14.57 gm	14.00 gm	15.08 gm	15.08 gm	14.09 gm
84.54 gm	87.43 gm	84.04 gm	90.50 gm	90.50 gm	84.53 gm
0.23 gm	0.17 gm	0.42 gm	0.25 gm	0.11 gm	0.19 gm
0.01 gm	0.01 gm	0.03 gm	0.02 gm	0.01 gm	0.01 gm
9.09 gm	0.06 gm	0.16 gm	0.09 gm	0.04 gm	0.07 gm
0.68 gm	0.71 gm	1.15 gm	0.70 gm	0.67 gm	0.67 gm
0.04 gm	0.04 gm	0.07 gm	0.04 gm	0.04 gm	0.04 gm
0.26 gm	0.27 gm	0.43 gm	0.26 gm	0.25 gm	0.25 gm
9.00 mg	7.07 mg	12.00 mg	8.67 mg	7.26 mg	7.26 mg
0.56 mg	0.44 mg	0.75 mg	0.54 mg	0.45 mg	0.45 mg
3.38 mg	2.65 mg	4.50 mg	3.25 mg	2.72 mg	2.72 mg
1.08 mg	0:85 mg	J.69 mg	0.09 mg	0.03 丽夏	0.04 mg
0.07 mg	0.32 mg	0.56 mg	0.51 mg	0.15 mg	0.23 mg
0.45 mg	0.37 mg	0.57 mg	0.45 mg		0.14 mg
0.03 mg	0.02 mg	0.04 mg	0.03 mg		0.01 mg
0.17 mg	0.14 mg	0.21 mg	0.17 mg		0.05 mg
		14.00 mg			3.00 mg
		0.88 mg			0.19 mg
		5.25 mg			1.13 mg

396.00 IU (USP) 25.00 IU (USP) 148.50 IU (USP)

(c) USDA, Bureau of Home Economics, Nutritive Value of Ome Pound of Specified Food

Materials (table D-6), continually being revised.

(d) Values for Calcium, Iron, Thiamin, Riboflavin, and Vitamin D are from Federal Register, August 3, 1943, page 10,787; values for Calories, Protein, Fat, Carbohydrate, and Phosphorus are from Sherman (see footnote (a)).

⁽b) Taylor, Clara M., Food Values in Shares and Weights, MacMillan, New York, 1942, pages 60-61. Values were calculated by enlarging given weights to the 100 gm. level, using various factors, and by then transposing into pound values as in footnote (a).

⁽e) Values for Calories, Protein, Calcium, Iron, Thiamin, and Riboflavin are from Taylor (see footnote (b)) the value for Phosphorus is from Rose, M. S., A Laboratory Handbook for Dietetics, MacMillan, New York, 1937, page 148; values for Fat and Carbohydrate were reckoned by adding 2 of whole wheat bread figures to 2 of white bread figures (see footnote (a)).

		BOSTON	CORN BREAD,	CORN BREAD,	CRACKERS
PUMPER-	BISCUIT,	BROWN	WHITE MEAL	YELLOW DE-	(c)(h)
NICKEL	BAKING POWDER	(a)(g)	(f)	GERMINATED	
(b)(g)	(a)(h)	(4)(6)	\ /	MEAL (f)	
					2005
1057	1683	1348	1210	1177	1885
66	105	84	76	74	118
396	631	504	454	441	707
		07 00	97 77 mm	24.93 gm	43.60 gm
30.21 gm	42.18 gm	27.22 gm	27.33 gm 1.71 gm	1.56 gm	2.73 gm
1.89 gm	2.64 gm	1.70 gm	10.25 gm	.9.35 gm	16.35 gm
11.33 gm	15.82 gm	10.21 gm	10420 8		
	62.14 gm	28.58 gm	39.53 gm.	32.00 gm	43.60 gm
	3.88 gm	1.79 gm	2.47 gm	2.00 gm	2.73 gm
	23.30 gm	10.72 gm	14.82 gm	16.00 gm	16.35 gm
	20000 621				W00 00
	238.59 gm	244.94 gm	221.73 gm	234.00 gm	329.80 gm
	14.91 gm	15.31 gm	13.86 gm	14.63 gm	20.61 gm
	89.47 gm	91.85 gm	83.15 gm	87.75 gm	123.68 gm
				0 07	0.10 gm
0.08 gm	0.28 gm	0.59 gm	0.03 gm	0.03 gm	0.01 gm
0.01 gm	0.02 gm	0.04 gm	0.00 gm	0.00 gm	0.04 gm
0.03 gm	0.11 gm	0.22 gm	0.01 gm	0.02 8	3
	0.44	. 0.84 gm	0.42 gm	0.42 gm	0.46 gm
	0.44 gm	0.05 gm	0.03 gm	0,03 gm	0.03 gm
	0.03 gm 0.17 gm	0.32 gm	0.16 gm	0.16 gm	0.17 gm
	0.11 811	54.2.0			
6.80 mg	2,49 mg	13.60 mg	2.99 mg	2.99 mg	6.80 mg
0.43 mg	0.16 mg	0.85 mg	0.19 mg	0.19 mg	0.43 mg
2.55 mg	0.93 mg	5.10 mg	1.12 mg	1.12 mg	2.55 mg
			n as =6	0.25 mg	0.70 mg
0.06 mg	6.60 mg	6.54 mg	0.06 mg	0.02 mg	0.04 mg
0.33 mg	0.01 mg	0.21 mg		0.09 mg	0.26 mg
0,000					
0.27 mg	0.30 mg	0.32 mg	0.34 mg	0.23 mg	0.14 mg
0.02 mg	0.02 mg	0.02 mg	0.01 mg	0.01 mg	0.01 mg
0.10 mg	0.11 mg	0.12 mg	0.13	0.09 mg	0.05 mg
		•	1 00	1 00	9 97
			1.80 mg	1.80 mg	2.27 mg
			0.11 mg 0.68 mg	0.11 mg	0.14 mg
			0.00 mg	0.68 mg	0.85 mg

333.32 IU (USP) 20.83 IU (USP) 124.00 IU (USP)

(g) Usual Ingredients: Pumpernickel--mixture of flours plus potato mash and other ingredients; Boston brown bread--equal portions of corn meal, whole rye flour, and

whole wheat flour plus molasses and other ingredients.

⁽f) Values were computed from figures of corn meal in USDA table (see footnote (c)). Two-thirds of the figures recorded for corn meal were used since, according to Food Research Laboratories, New York, bread is 35% moisture (by weight). Also, one tablespoon (28.4 gms) of fat was allowed in the bread which boosts the Calorie and Fat figures of USDA table. Recipe for one pound of corn bread is: 2 cups of corn meal, 1 tablespoon of fat, salt, and water.

⁽h) These breads were analyzed before the present legislation requiring enrichment of white flour and white bread was effective. Therefore, such breads today will have different values for iron, thiamin, riboflavin, niacin, and probably for calcium and vitamin D.



